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### **Session 1: Intelligent Transportation and Urban Planning**

Time: 8:00am-12:25pm, October 24th Location: 32-D463 Chair(s): Hao Sheng

### Why Do We Need Bilateral Control? - In View Of Energy Consumption "% Author(s): Taivi Wang, Yajun Fang, Berthold K.P. Horn,

**Abstract:** Bilateral control is a kind of new control system proposed by Berthold K.P. Horn, MIT, in 2013. Using information from both sources which allows the gain of feedback to be reduced below one, the new control system effectively eliminate the instability characteristic of "car following." model. In addition to its intrinsic characteristics, suppressing the traffic flow faster, people are more concerned about how much energy consumption or fuel consumption can be reduced by such a new mechanism. Taking various factors into account, including platooning effect, the article presents a general calculation method here.

### A Bottom-Up Design Model for Improving Efficiency of Transit System "+

Author(s): Jiayang Li, Ruzhang Zhao, Yanfeng Ouyang, Meng Li

**Abstract:** This paper presents a model to design high- performance public transit system, where the optimal solution is directly selected from routes built up on real road structure. The objective function is the travel time for all travelers and the infrastructure cost can also be under consideration. The optimization procedure consists of four components, including a method to simulate downtown travel demand using open- source data on the Internet, a method to narrow down the decision variable space with the help of reasonable restriction and map api, an efficient algorithm to compute average travel time using block representation of the urban area and an improved evolutionary algorithm to search the optimal solution. Eventually, this method is applied to design the transit system for Changzhi, China. The optimal solution is compared to the original transit system of Changzhi to test both the effect and reasonability of the algorithm.

#### Analysis of Sparse Roadway Trajectories<sup>...</sup>%

#### Author(s): Sudarshan S. Chawathe

**Abstract:** Recent technological advances enable the gathering of extensive data on vehicular trajectories of large numbers of travelers at an unprecedented level of detail. Such trajectory datasets provide a wealth of information for purposes such as urban planning, carpool formation, and public-transportation design. This paper describes methods for analyzing and visualizing such data with an emphasis on sparse-traffic environments. It outlines the needs of applications in this domain and presents methods for clustering trajectories and for visualizing the results. The methods are evaluated by an experimental study on a publicly available dataset from real travelers.

### An object tracking algorithm for static camera<sup>...</sup>B#5

**Author(s):** Lianfeng Shil, Guanghua Chen, Yang Liu, Yajun Fang, Berthold K. P. Horn

**Abstract:** Mainstream surveillance system takes a huge investment both in terms of workforce and time. As people are pursuing a smarter way of managing cities, the current methods of surveillance limits the efficiency and smartness of the city. Abnormal activity detection of video is an algorithm that devotes to finding unusual activities in a certain clip of video. This can filter out the normal scenes and let the human monitors focus on scenes that may contain accidents. Previous works either doesn't use object tracking at all, or they can only track moving objects, which will lost a lot of useful information. This research project proposes an improved approach to track objects in the scene, with a unique combination of feature point tracking and optical flow. Feature points keep tracking objects, and optical flows decide which feature points that are valuable to be tracked. Further more, this algorithm can control the density of feature points to reduce computation. This algorithm can be integrated into smart city system, can be used to statistically analyze the traffic condition of the city automatically.

### Adaptive Spatio-temporal Model Based Multiple Object Tracking in Video Sequences Considering a Moving Camera<sup>11</sup>%

**Author(s):** Yi Tao, Jiahui Chen, Yajun Fang, Ichiro Masaki, Berthold K.P. Horn **Abstract:** Tracking multiple objects in a moving camera is challenging. Due to the irregular movements of the camera, the displacement, scale, and appearance of the objects can be difficult to predict and track. To cope with these problems, we propose an Adaptive Apatio-temporal (AST) model, which

explicitly estimate the movement and scale of targets in the view of the moving camera. Moreover, the interactions among objects are also considered to increase the robustness. We introduce our model to the multiple hypothesis tracking and achieve a competitive result on the public benchmark, which includes video of both moving and statistic camera.

### A Method to Extract Overall Trajectory Information from Frame Sequence of Fixed Background without Object Tracking<sup>...</sup>&)

**Author(s):** Hongkai Chen, Yang Liu, Yajun Fang, Guanghua Cheng, Tianhong Shen, Berthold K.P. Horn

**Abstract:** We present a novel method for overall trajectory information extraction from RGB frame sequence of fixed background.In contrast to existing methods using object detection and tracking, which focus on individuals' trajectories,our method extract overall trajectory information without needs for object tracking,which brings about considerable reduction on computation cost.Rather than tracking every object, we detect objects of each frame, recording their central positions.These positions are then joint to form a 2D trajectory point cloud.A clustering algorithm is then performed on the 2D point cloud to extract overall trajectory information.Our method shows a significant potential on realtime traffic analysis for the feature of low computation cost and the extraction of overall information.

### Real-time Vehicle Status Perception Without Frame-based Segmentation for Smart Camera Network<sup>3</sup>

**Author(s):** Jiahui Chen, Yajun Fang, Hao Sheng, Ichiro Masaki, Berthold Horn, Zhang Xiong

**Abstract:** Nowadays camera network plays an important role in the Intelligent Transportation System (ITS), and due to the weak computing ability of smart devices in the camera network, collecting traffic status in real time is one of the critical tasks in this field. A common strategy for traffic status collecting is first to form the trajectories of vehicles and then to measure interested indicators. To address this problem, we present a real- time vehicle status perception approach, which directly extracts vehicle status from our proposed novel video feature, temporal component-weight. Specifically, temporal component-weight is calculated based on a sampling of the whole frame. Also, a hybrid model is proposed to handle crowded situations. We test our approaches in surveillance sequences, and the results show that the proposed approach can effectively collect the vehicle status, including number, relative location, and relative speed.

### Autonomous Mobility and Energy Service Management in Future Smart Cities: An Overview<sup>...</sup>)

Author(s): Xiaoqi Tan, Alberto Leon-Garcia

Abstract: With the rise of transportation electrification, autonomous driving and shared mobility in urban mobility systems, and increasing penetrations of distributed energy resources and autonomous demand-side management techniques in energy systems, tremendous opportunities, as well as challenges, are emerging in the forging of a sustainable and converged urban mobility and energy future. This paper is motivated by these disruptive transformations and gives an overview of managing autonomous mobility and energy services in future smart cities. First, we propose a three-layer architecture for the convergence of future mobility and energy systems. For each layer, we give a brief overview of the disruptive transformations that directly contribute to the rise of autonomous mobility-on-demand (AMoD) systems. Second, we propose the concept of autonomous flexibility-on-demand (AFoD), as an energy service platform built directly on existing infrastructures of AMoD systems. In the vision of AFoD, autonomous electric vehicles provide charging flexibilities as a service on demand in energy systems. Third, we identify four key decisions that, if appropriately coordinated, will create a synergy between AMoD and AFoD. Finally, we discuss key challenges regarding the system-wide coordination between AMoD and AFoD.

### Designing Intelligent Spaces as if They Were Human: A "Space Agent" Framework" (%

**Author(s):** Yixiao Wang, Keith Evan Green, Rod Grupen, Johnell Brooks, Ian D. Walker

**Abstract:** The literature of communication theory suggests that people tend to interact with interactive artifacts as if these were human. For decades, this understanding has been applied to designing computer embedded devices at small physical scale (i.e. objects). In this paper, the authors extend this same

understanding to the dimension of space—to designing intelligent, physical environments. The conceptual ground for this design intention is found in a "pattern language" developed by Alexander, et al. for designing static physical environments based on the "best guesses" of architects. Upon this foundation of a pattern language, the authors offer a design framework based on our novel concept of "space agency" whereby observed human-human interaction is translated into human-machine Interaction for spatial artifacts by way of two mapping techniques. Our intention is to strive for more human-human-like interactions between human beings and intelligent spaces whereby intelligent spaces become friendly, helpful, and welcoming. In this paper, the design of an interior space within a fully autonomous vehicle provides a case study. The framework presented here has significance for designing intelligent artifacts and interactions with them as these extend, inevitably, to the dimension of space, entertaining, serving, and augmenting our increasingly digital and human-centered society.

### A Study on Correlation Analysis and Application of Communication Network Service<sup>...</sup>(+

**Author(s):** Bingqing Liu, Hongyan Cui, Xue Qiu, Tao Yu, Haiyong Xu, Yan Huang, Meng Xu

Abstract: Research on mobile network user behavior is of vital importance for mobile communications services. However, in most cases, large amounts of data are collected in a dispersed way and irregularly, impeding operators from offering reasonable business recommendations for users, hence business managers can hardly satisfy customers' needs. Therefore, we conduct a correlation analysis of mobile data, including a correlation analysis between a user's mobile network business and district, between business and time, and between business and business. In the process of analyzing, based on the Hadoop distributed computing platform, we apply the FP-Growth correlation algorithm to analyze real communication data from operators, obtaining the business type transition law of the network service types of users. Then, by applying the K-means algorithm, we cluster the data of base stations in the city, classify and count the network traffic flow used by users in each area and acquire their preference of network access. Furthermore, through the visualization of base station data of network businesses. mobile data could be better applied and analyzed. The study is useful for achieving the optimization of resource allocation and communication network service provided by operators, contributing to the better guidance of urban planning.

### Emergency Preparedness System- Environment Warning of Waterlog<sup>•••</sup>B#5 Author(s): Yuchao Wan, Yajun Fang

**Abstract:** Beijing suffered the strongest rainstorm and flood disaster in 61 years on July 21, 2012. 79 people have died in heavy rain. The number of houses collapsed to 10,660, and more than 1.602 million people were affected by heavy rains, with an economic loss of 11.64 billion yuan. Therefore, the paper would discuss more about the current situation of the Emergency preparedness system of Waterlog in China.

### Session 2: Healthcare and Well-being

Time: 8:00am-11:10am, October 24th Location: 32-G449 Chair(s): Hongyan Cui

### A Survey on the Status of Smart Healthcare from the Universal Village Perspective ")'

**Author(s):** Guoxin Huang, Yajun Fang, Xiushi Wang, Yu Pei, Berthold K.P. Horn **Abstract:** This survey paper discusses the condition of smart healthcare implementation. It discusses the current healthcare problems and how smart healthcare technologies ease the problems. Our group, Universal Village, realizes that the integration and interaction between parties in a system will maximize the effectiveness and benefit for the system. Based on this idea, this paper considers the smart city system as a whole, and talks about how smart healthcare interacts with infrastructures and functions inside and outside of the smart healthcare field. Then, it analyzes how a more powerful integrated system can be built from the smart healthcare system. In the end, several case studies are listed. Based on our analysis and the case studies, this paper then ended with the future prospects of the smart healthcare.

### Analysis of Information Exchange: How Does It Affect Patient-Hospital Relationship?") -

Author(s): Xiao Yang, Yajun Fang, Berthold.K.P. Horn

**Abstract:** The purpose of this paper is to propose a systematic solution to improve human healthcare situation and to amend the current medical and healthcare systems. The paper first evaluates the current smart healthcare technologies and their progress in different regions, then identifies the major limitation of current smart healthcare systems, specifically the current challenges of patient-hospital relationship and how insufficient communication between hospitals and patients jeopardize the patient-hospital relationship. The paper analyzes several impacting factors, including the interactions between smart healthcare system and other smart systems under the framework of smart cities, and how these factors would affect the whole systems systematically. Under such a framework we discuss in this paper how to enhance the patient experience in hospital by smart healthcare technologies and solve the problems of unsatisfying relationship between patients and hospitals. The studies are conducted from the following three aspects: hospitals exchange information, patients learn about hospitals, and hospitals gather data from patients. The research introduces different examples of medical technology and of intersections between healthcare system and other systems. However, due to the difference of medical resources and the development of infrastructures in different countries, smart healthcare system still need amendment.

### Recognizing Activities of Daily Living Using Binary Sensorg<sup>…</sup>\*(

Author(s): Sudarshan S. Chawathe

**Abstract:** Activities of Daily Living (ADLs), or a person's routine activities of selfcare, are important factors influencing the feasibility of home health care or aging in place for many individuals. Automated, sensor-based recognition of such activities affords home stay, greater independence and privacy, and improved quality of life to individuals who would require stay in a supervised or medical facility. This paper describes a data-driven framework for the design and deployment of such an automated system for activity recognition using simple, unobtrusive, and privacy-friendly binary sensors. It presents the results of an experimental study, with both numerical and qualitative observations, of this framework on a publicly available real dataset.

#### Machine Learning on Cataracts Classification Using SqueezeNet<sup>...</sup>+\$

**Author(s):** Xingzhi Qian, Evan W. Patton, Justin Swaney, Qian Xing, Tingying(Helen) Zeng

**Abstract:** Cataracts is a serious eye disease, affecting over 20 million people worldwide. It is the clouding of the lens, which blocks the light to go through the lens and project on the retina. As a result, the nerve cannot transfer the whole image to the brain, leading to blindness. A vast majority of cataracts patients are people who are over 50 years old. To classify different areas of cataracts in lens, we use supervised training of convolutional neural network to train 420 images of cataracts on the lens taken from slit-lamps. The experiment can make the future of classifying cataracts more easily and ophthalmologists can apply operations to different categories of cataracts within a shorter time to cure patients with cataracts. For those people in the countryside, even not so experienced doctors can take the photo of lens and use the program to classify cataracts correctly.

### A Study on Multidimensional Medical Data Processing Based on Random Forest<sup>…</sup>B#5

Author(s): Lifeng Zhang, Hongyan Cui, Roy E.Welsch

**Abstract**: In the field of medical research, when researchers use physical examination indicators to diagnose diseases, it is often difficult to make decisions because of the large number of data dimensions. It is also tough to make effective decisions on whether or not to be ill according to relatively important attributes. Under such circumstances, this paper proposes a feature extraction method based on random forest, which extracts features from multidimensional data. With validation of the UCI diabetic retinopathy data, we designed a method to calculate the impact score of multi-dimensional attributes to the presence or absence of disease. Then, by selecting two groups of data with higher impact score and lower impact score. Last, we used neural network algorithm to make comparative verification. The experimental results show that the high-impact score data calculated by the random forest has certain advantages over the low-score data in disease diagnosis, both on the accuracy of the diagnosis model and the diagnosis. We choose to use this method to select fewer features with higher scores to diagnose diseases, and also achieve good results.

### Plant Disease Identification Using Convolutional Neural Networks<sup>\*\*\*</sup>B#5

Author(s): Kevin Zeng Qi, Justin Mark Swaney, Evan W. Patton

**Abstract:** Plant diseases are a major threat to food security for public health. The goal of this research is to develop an effective system that can detect these diseases before they become widespread. We combat this by innovatively training a convolutional neural network to detect and identify diseases from the RGB images of plant leaves. The architecture of the network is based on the Alexnet architecture. The dataset consisted of corn, tomato and apple leaf images. The results were to be very promising with a 92.22% accuracy when trained and tested on the specific labels of each disease and species.

### First-Aid system desigb<sup>···</sup>B#5

**Author(s):** Haoran Ma, Yang Liu, Yajuan Fang, Berthold K.P.Horn **Abstract:** For the new upgrade of an existing first-aid system, the method of combining mobile device with Internet is adopted to realize the real-time feedback of patients' location information, query the corresponding first-aid methods and call nearby resources, so as to shorten the time of first-aid for patients and save their lives.

### **Session 3a: Intelligent Communities**

Time: 8:00am-10:30am, October 24th Location: W20-306 Chair(s): Gilly Leshed

#### UniWifi, A Smart Network System<sup>"B#5</sup>

#### Author(s): Harry Zhou, Bruce Wang

Abstract: As people become more and more reliant on wifi to complete day to day tasks, individuals also become increasingly restricted to their homes or places that provide it. We propose an Intelligent Network System that could provide constant wifi connection to the masses so that anyone could roam anywhere within an urban area and remain connected to the internet. Our concept revolves around using the contemporary 'mesh zone' technology. In phase one, we believe that by having small yet powerful routers installed everywhere, mesh zones that be created to effectively cover areas small and large. In phase two, the potential of having routers moved to the skies becomes probable when combined with high performance drones. The goal is global connectivity. We envision for a future where every device around the globe is connected to one or many central network databases. This is important because all internet traffic could be monitored and therefore greatly eliminating most if not all potential intrusions to civilian safety all around the globe. There are three checkpoints that we would like to accomplish. First, to test the connectivity range of a mesh router with a commercial drone. Then to successfully build our own beta prototype flyer. And at last, to test our beta flyers with multiple mesh routers to complete a working mesh zone. Wifi routers today are not being used to their full potential as they ironically work independently to connect collective devices to the web. By implementing mesh, one could connect to secure and fast connection while having mobility freedom. One could truly stay connected anywhere and everywhere.

### CoDAS, a Method for Envisioning Larger-Scaled Computational Artifacts Connecting Communities<sup>\*\*\*</sup>+'

**Author(s):** Carlos Araujo de Aguiar, Gilly Leshed, Alexander Bernard, John McKenzie, Camille Andrews, Keith Evan Green

**Abstract:** Information Technologies are increasingly embedded into artifacts of the physical world—furniture, rooms, buildings, and urban infrastructure—making communities around-the-globe more connected and, arguably, more intelligent. However, such larger-scaled, social computing artifacts arrive with critical concerns of cost, material choice, design requirements, fabrication means, robust and safe use, power, and resistance to vandalism and the elements. Given the complexity of realizing larger-scaled, computational artifacts, conventional design methods prove inadequate and potentially costly and dangerous if researchers move too quickly to full-scale prototyping. In this paper, we present CoDAS, a hybrid methodological approach that combines elements of well-known HCI methods to effectively develop larger-scale social computing artifacts.

#### A survey of Multi-controllers Consistency on SDN<sup>…</sup>+-

#### Author(s): Tao Yu, Yang Hong, Hongyan Cui, Hongxiang Jiang

**Abstract:** Software-Defined Network (SDN) is developing rapidly for its benefit of programmability. However, new challenges also appear. One of them is while we are applying distributed controllers in SDN networks, we must consider the consistency problem. In SDN networks, especially in a multi-controller architecture, it is a great challenge to maintain a global view consistency of the networks among all controllers, which is also key to issue flow regulations. Lacking of consistency in packets, flows, and networks level may result in serious errors. Besides, consistency problem also exists in data plane. How to keep all switches executing a same set of rules to avoid errors is often discussed. In this paper we'll conclude the different situations of consistency problems and provide the related research solutions. The methods in the paper not only regard to consistency of control plane, but also data plane. At last, we also introduced the two methods to evaluate the performance of consistency, those are strong consistency and final consistency.

#### Anonymous network communication based on SDN<sup>…</sup>, )

**Author(s):** Taiyu Wong, Hongyan Cui, Yuepeng Shen, Wenqi Lin, Tao Yu **Abstract:** As more and more personal information is used in network services, network anonymity has received more and more attention. Attackers could endanger the victims' privacy by attacking or eavesdropping nodes during the networks routing. For example, attackers could retrieve the IP and MAC address of victims from network traffics, and use it to correlate the network behavior to individuals. The emerging Software Defined Network (SDN) technique provides a pretty flexible platform that can control the whole network by software programming, which propose a new solution to realize the network anonymity problem. In this paper, we propose a solution based on SDN to anonymize both MAC and IP addresses of network traffics in order to mitigate the privacy threats, and programing it. Furthermore, we test the anonymity function on our SDN Testbed. Our solution supports two working modes: a two-way anonymous mode which anonymizes the IP and MAC addresses of all data packets, and an one-way anonymous mode which anonymizes MAC and IP addresses of senders.

#### Friendly Acoustic Technology Enhance Neighborhood and Friendship<sup>11</sup>B#5 Author(s): Zhang Xiangdong, Kuang Zheng, Yang Jun

**Abstract:** It is estimated that there are currently 80 million to 100 million square dance crowds in China. Due to noise pollution, there are often quarrels and conflicts between the square dance crowd and their neighbors. Even in order to compete for the venue, there will be disputes between different square dance teams. The directional sound product based on local sound field control technology, combined with big data and mobile internet technology, composed the intelligent square dance system. It provides an ideal solution for the above contradictions, and has been piloted in several communities in Suzhou, China, and has won unanimous praise from all parties. This system, as an example of an IoT complex, can be widely used elsewhere.

### Method of intonation conversion for facilitating English communication between native and non-native speakers<sup>11-</sup>

Author(s): Tomoko Nariai, Hiroaki Kojima, Hiroyuki Obari, Shiroh Itai

**Abstract:** With the growth of the Internet and globalization, hardships in English speech communication became more serious for non-native speakers. It would be desirable to develop a speech communication device which can convert English speech into a more intelligible one for listeners. In this study, English speech was hypothesized to be more intelligible to non-native listeners by being modified into the listeners' native language speaking style. First, the characteristics of English between native and Japanese speeches were statistically analyzed. The analysis determined the modification model marked modification of intonation of native speakers' speech so as to include Japanese characteristics. The hypothesis was realized by speech modification generated by a speech analysis, modification and synthesis system, STRAIGHT. Then, the modified speeches were evaluated on the basis of listening experiments involving Japanese listeners. The experiments consisted of dictation tests and preference tests, and resulted in an increase in the scores. The results, therefore, verified the hypothesis. This also revealed the potential feasibility of the speech conversion method which facilitates spoken English communication.

### Session 3b: New Lifestyles Enabled by Big Data

Time: 12:00pm-2:05pm, October 24th Location: W20-306 Chair(s): Wei Ke

### The Clustering for Clients in a Bank Based on Big Data<sup>…</sup>-\*

**Author(s):** Jie Zheng, Hongyan Cui, Xiaoqiu Li, Lingge Meng, Tian Wang **Abstract:** Many technologies about data mining, such as clustering, have been widely applied in the context of bank to understand the behaviors of the clients and investors. Unlike some classic clustering validity index using compactness and separation, we employ Pairing Frequency Clustering Validity Index (PFCVI), which uses pairwise pattern information and focuses more on logical reasoning than geometrical features. We use PFCVI to evaluate the clustering quality under different c and find the optimal value of c is 11 based on the bank's data, and clients in the 11 classes have different savings values potential levels and different fluctuation pattern. Then, we sum up the above 11 classes into 5 categories with different fluctuation pattern – stabilized savings values category, fluctuant savings values category, risen savings values category, fallen savings values category and abnormal savings values category. Finally, we analyze each category with techniques like user profile and give some targeted advice for each category aimed at optimal market segment.

### GENERATING POETRY WITH STEM-BASED LSTM NETWORK "B#5

**Author(s):** Yifan Wu, Tingying(Helen) Zeng, Evan W. Patton, Justin Swaney **Abstract:** Natural language generation (NLG) of poetry has been a difficult task in machine learning. In this paper, we propose a two-stage poetry generation system inspired by the stemming process in natural language processing. The system first transfers the learning text into stem words and models the task as a sequence-tosequence learning problem. The system then runs a separate model that transfers the generated stem words back to normal text. This system enables a way of text generation that achieves better readability in a resource limited setup compared to a single word- or character- based model.

#### NUBILUM AD HOMINEM: Taking smart homes steps further \*\*\* \$\$%

Author(s): Chuyuan Zhang, Yajun Fang, Berthold K.P. Horn

**Abstract:** Smart home technologies are developed with the goal of offering convenience to their users, but the currently available technologies are reactive, either to user commands or to user routine, as opposed to being proactive, and are not capable of taking the environment around the user into consideration when making an analysis. In addition, most existing systems have a strictly top-down hierarchical structure, where a central device such as the user's mobile phone controls the system to the point where the lack thereof impacts the functionality of the system on a tremendous scale, and may sometimes result in a cascading failure rendering the entire system inoperable. This article focuses on the relationship and connection between various unconnected data points scattered across a person's quotidian life, as well as the decentralized connection between

smart home devices, both on a microscopic and on a community scale. It seeks to propose an alternative system that takes into account not only user commands and routines, but also pieces of information disseminated by the surrounding environment, which the user might not have perceived or understood, and incorporates them into its own process of analysis. Furthermore, the proposed system emphasizes modularization and decentralization, such that the addition and removal of a node should not impact the system outside of the specific functionality provided by the said node.

#### MyNeighbourhood-The Human Smart City Village<sup>\*\*\*</sup>B#5

#### Author(s): Álvaro OLIVEIRA, Irani SANTOS

**Abstract:** This paper argues that cities themselves have to play a strategic and foundational role in the conceptualisation, development and implementation of a Human Smart City model, able to address the local or global societal challenges they face today. The Human Smart City concept aims at developing a citizendriven, smart, all-inclusive and sustainable environment, with a new governance framework in which citizens and government engage in listening and talking to each other. This public governance model favours the emergence of a participatory innovation ecosystem that creates jobs. The MyNeighbourhood project aims at implementing this concept at a neighbourhood scale, demonstrating its viability and positive impact. It will identify the wishes, interest and needs of the citizens (referred as WIN) by involving them in a co-design process leading to the co-creation of solutions. "Smart" ICT services building upon data provided by the citizens are used to recreate the social bound between neighbours and their link to the physical place of the neighbourhood.

### Analysis of the relationship between life satisfaction and waste behaviors "B#5 Author(s): Fuxin Du, Yajun Fang, Yang Liu, Berthold K.P. Horn

**Abstract:** With the advancement of technology and science, people's life becomes colorful and convenient. In order to suit for people's needs, the increasingly number of factories would product a wide range of products that may be not that necessary in people's life. However, producing these stuff seriously influence the environment, which not only is about the waste during the processing, but also causes the severe pollution to natural mother. Thus, it will be helpful for people to do some researches about investigating the relationship between life satisfaction and waste behavior, which may help scientists to find a feasible and valid way to keep the balance between the environmental protection and the growth in the living standards. This essay is mainly concerned with analyzing the correlation of index and giving the conclusion about how to balance the waste behavior and high living standard.

### Session 3c: Smart Solutions with AI

Time: 2:05pm-4:25pm, October 24th Location: W20-306 Chair(s): Xiying Li

### The Future of Optical Character Recognition use in Accounting.<sup>...</sup>B#5 Author(s): Lu Gerry

**Abstract:** In recent years, I have identified a problem. This problem is the did proportionate amount of lower income families facing the law because they are unable to pay their taxes without the help of an expensive accountant. My idea to solve this problem is to create a AI that can be used to easily help people with their taxes. I plan to do this through ORC. I propose a software that can take a photo of multiple receipts and then instantly be able to extract information from the photo such as totals, subtotals and GST. Then after using this information the software will fill in a tax return, ex: T1 tax return in Canada. In the future I want this to be available all people, thereby bypassing expensive accountants, and helping low income families to stay on the right side of the law.

### FASTER R-CNN over ATTENTION: Shared Bike Detection in Surveillance Video<sup>...</sup>B#5

#### Author(s): Xuelin Yang, Xiying Li

**Abstract:** The illegal parking of prevalent dockless shared bikes poses inconvenience and threat to traffic safety, which is mainly regulated by inefficient manual searching in the city. In this paper, we enable the effective regulation using detection results from surveillance videos. In state-of-the-art detection networks, advances like Faster R-CNN have reduced running time, exposing limitations in processing consecutive images. We introduce the model of Faster R-CNN over Attention (FoA), which is able to accomplish fine-grained detection of shared bikes in videos. We combine an Attention Region Extraction (ARE) with Faster R-CNN, and put forward an Anchor Box Optimization of the network. We also build a labeled data set of shared bikes with 4,291 images and 12,697 objects, and test the algorithm on it. The FoA, as well as the data set, can be utilized in other scenes of surveillance video detection.

#### Seat arrangement for an arena<sup>"B#5</sup>

Author(s): Haosen Cao, Yang Liu, Yajun Fang, Berthold K.P Horn

**Abstract:** This paper proposes that Crowd Capsule, designed by lending from well-known sociological theories of crowd control, would lessen the uncertainty of large venue crowd safety by not only reducing the chance of large-scale emergencies occurring by but also providing the plan for a structure that would reduce the loss of both human resources, health, and even life, due to unforeseen emergency situations.

### A Simple Change Comparison Method for Image Sequences Based on Uncertainty Coefficient<sup>11</sup>%/&

Author(s): Ruzhang Zhao, Yajun Fang, Berthold K.P. Horn

**Abstract:** For identification of change information in image sequences, most studies focus on change detection in one image sequence, while few studies have considered the change level comparison between two different image sequences. Moreover, most studies require the detection of image information in details, for example, object detection. Based on Uncertainty Coefficient(UC), this paper proposes an innovative method "CCUC" for change comparison between two image sequences. The proposed method is computationally efficient and simple to implement. The change comparison stems from video monitoring system. The limited number of provided screens and a large number of monitoring cameras require the videos or image sequences ordered by change level. We demonstrate this new method by applying it on two publicly available image sequences. The results are able to show the method can distinguish the different change level for sequences.

#### A Continuous Integrated Website Architecture Design<sup>11</sup>B#5

Author(s): Galvin Gao

Abstract: A Continuous Integrated Website Architecture Design.

### Session 4: Data Management

Time: 8:00am-10:20am, October 24th Location: 32-262 Chair(s): Wengiang Wang

#### Analysis of the Uniformity of Light in a Plant Growth Chamber "%+

Author(s): Yong Xu, Hanbin Wang, Walter Nsengiyumva

Abstract: Plant growth is greatly affected by light. However, the uniformity of light in plant growth chambers has always been a common problem that was not appropriately addressed. As this, the uniformity of light in a plant growth chamber illuminated by light-emitting diodes (LEDs) was investigated in this paper. The orthogonal experimental design method was used to test the influence of various factors on the uniformity of light intensity in a plant growth chamber using the lighting simulation software DIALux. The major factors investigated in this paper include the divergence angle, number and arrangement of LED lamps, as well as the reflectivity of the inner walls of the chamber and the minor factors include the vertical distance from the LED board and the distance from the board edges. The relative importance of influence of each factor on the uniformity of light in the chamber was obtained and finally, an optimized model of the plant growth chamber with a uniformly distributed illumination was obtained. Simulation results showed that reflectivity of the inner walls had the highest influence on the uniformity of light on the working plane, followed by the divergence angle of the LED lamps, and the number of LEDs had the lowest influence. Therefore, the number of LEDs may mainly affect the intensity of light on the working plane but not the uniformity on the plane's illumination significantly, especially when the distance from the LED board is relatively large. Results also showed that the uniformity of light increases vertically from the LED board and with the edge distance as well. Based on our simulation results, a three-dimensional optimal cultivation area in a plant growth chamber was suggested which achieved the uniformity of 0.93.

#### CovNN: A Covariance Neural Network Extended from CNN<sup>...</sup>%(

Author(s): Yue Shen, Tianyou Zheng, Dandan Li, Zicai Wang

**Abstract:** Convolutional neural networks (CNNs) show commendable performance in computer vision, approaching high accuracy in a broad number of application domains. However, the training process of feature kernels in CNNs is easily affected by illumination intensity and feature interaction, which leads to overfitting. In this paper, we propose a covariance neural network (CovNN), which replaces the original convolutional operation with our covariance algorithm, to make the learned kernels more robust to different illumination conditions and irrelevant features. This covariance layer uses the 3D covariance between all the input feature maps and the corresponding group of kernels by sliding window method, and regularizes them without additional parameters. Moreover, the covariance layer can be seamlessly transplanted to a variety of neural network architectures extended from CNNs (e.g., ResNet, Faster R-CNN). We evaluate the proposed CovNN on several popular datasets for image recognition (MNIST, Fashion-MNIST, CIFAR 10 and AR) and classification of organs (Abdominal Ultrasound Dataset). Experimental results demonstrate that CovNN achieves significant improvements over the state-of-the-art on most of them.

### Simplifying Component Interaction with Actors and Databases "% \$

Author(s): Wei Ke, Lap-Man Hoi, Ka-Meng Siu

Abstract: Component-based software systems are of the majority nowadays. When it comes down to implementation, the interaction between components is just as important as the functionality itself. When invoking a function of a component, how to pass data arguments, how to receive return results, and when to expect a return are all the questions to ask. There are so many ways in which these can be done, that it introduces the complexity in the usability of a component. We present in this article an architecture for integrating heterogeneous components across different language and binary platforms, different processes and even different machines, based on a simple message passing mechanism --the actor model, and the sharing of common and global data structures only through databases. We show the simplicity and flexibility of this architecture by restructuring a slot machine framework, which consists of components to drive modern and legacy hardware, follows a static workflow, and changes the visual appearance quite often. We argue that this architecture with restricted implementation choices can be used in a much broader range of software systems, helping produce software components that are more independent and easy to adopt.

### A Survey on the Status of Open Data and Its Future "% +

**Author(s):** Xiushi Wang, Yajun Fang, Yang Liu, Berthold K. P. Horn **Abstract:** This survey paper looks at the open data, which is one of the most important elements of developing smart city and universal village. This paper focuses on the relationship between open data and smart city and the evaluation of open data projects. It describes the reason why data needs to be opened up, how open data should be evaluated, the current status of open data projects, and the challenges the open data developers are facing. Besides, the paper introduces the open data platform of the United Kingdom as a case study to explain open data project in the end.

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Author(s): Mark Allison, Heather Dawson, Grant Rusin

**Abstract:** Ecological data acquisition, refinement, and analysis methods have not kept pace with advancements in mobile sensor technology and applications of machine learning techniques due to the typical stovepiping of the sciences. Environmental sensor networks are an emerging technology which leverages advances in distributed sensing to realize real time rich data streams for researchers. When this network is made mobile it presents a disruptive technology with the potential to reveal new phenomena and questions as observations, that were once too dangerous or costly to obtain, becomes possible. In this concept paper, we motivate and present preliminaries in our investigation pertaining to the

use of Autonomous Underwater Vehicles (AUVs) in swarms to realize a mobile sensor network targeting invasive species in the Great Lakes.

### **Session 5: Green Energy and Materials**

Time: 10:20am-12:25pm, October 24th Location: 32-262 Chair(s): Tingying (Helen) Zeng, Qiang Wang

### Co-channel Interference of TD-LTE Wireless Network in Smart Grid "%)

**Author(s):** Rongduo Liu, Jiadong Du, Qi Wang, Wei Xin, Delong Song, Xu Liu, Hailun Xia

**Abstract:** As a private wireless network of smart grid, TD-LTE network use the same frequency band with other dedicated TD-LTE networks. There is an issue of co-channel interference to be studied. The co-channel interference could be described by Reference Signal Receiving Power (RSRP), Signal to Interference Plus Noise Ratio (SINR) at certain scrambling level and different interference field intensity. This paper presents a method to test the tolerance of the interference field intensity and the reference value of SINR in a certain RSRP value, with QoS as the evaluation index. The paper firstly investigates the category of smart grid services and Quality of Service (QoS) attribute value base on the specifications of power grid. Then the definition and causes of co-channel interference in LTE network are analyzed, and the method to evaluate the co-channel interference is given. Furthermore, a test by using the proposed method is given in the laboratory environment. More than 200 times of tests are repeated, and the delay, packet loss rate and throughput are obtained. The conclusion is finally given by comparing the test value with the required value of QoS. The data obtained in this test will provide reference for the design and optimization of the TD-LTE wireless network. And the method can be further used in the selection of the critical value of the finer network terminal RSRP.

### Integration of Solar PV Generation with Distribution Grid: Using Novel Adaptive Filter Based Control Technique<sup>...</sup>%)%

Author(s): Nishant Kumar, Bhim Singh, Bijaya Ketan Panigrahi

**Abstract:** In this work, a Novel Adaptive Filter (NAF) is proposed for optimal control of grid-integrated solar PV (Photovoltaic) generating system. The proposed NAF is the improved form of classical adaptive vectorial filter (AVF), where inherent problems of AVF technique, like unable to handle the phase imbalance and phase shift issues, are successfully mitigated. For performance evaluation of NAF based control technique, a single-stage topology of three-phase grid integrated solar PV system is taken, where the loads are connected at the PCC (Point of Common Coupling). The prime objective of proposed NAF based control technique is to meet the active power requirement of loads from generated solar PV power, and after fulfill the load demand, the excess power is supplied to the grid. However, when generated PV power is not sufficient for the load then the NAF based control

fulfills the load demand by taking extra required power from the grid. During this process, the power quality of the grid power is improved. The controller action provides, power factor correction, harmonics filtering and mitigation of other power quality issues. Moreover, when the solar irradiation is zero, then the voltage source converter acts as a distribution static compensator (DSTATCOM), which enhances the utilization factor of the system. The proposed techniques are modeled and their performances are verified experimentally on a developed prototype, in solar insolation variation conditions, unbalanced loading, as well as in different grid disturbances such as overvoltage, under-voltage, phase imbalance, harmonics distortion in the grid voltage etc.

#### Utility Grid Assisted Automated Solar PV Powered Energy-Efficient Eco-Friendly Water Pumping System With Improved Power Quality Performance<sup>(\*)</sup>) + Author(s): Shadab Murshid, Bhim Singh

Abstract: This work proposes the development of a solar photovoltaic (PV) array powered permanent magnet synchronous motor (PMSM) driven water pumping system. Owing to intermittent nature of solar energy due to continuously varying insolation level, the presented system proposes the introduction of utility grid, which ensures a reliable and uninterrupted operation of water pump. The pump operates at a rated flow rate when integrated to the grid. The power flow from single phase utility grid is facilitated using a boost converter for power factor correction. Along with maintaining the DC link voltage, the boost converter improves the power quality performance in terms of reduced total harmonic distortion and unity power factor operation. An improved orthogonal signal generator (IOSG) is used for extraction of fundamental positive sequence component from the grid voltage. An incremental conductance algorithm is used for extracting maximum power from the PV array. A back emf based sensor-less technique is utilized for estimation of speed and position. The performance of proposed system is experimentally validated for different modes of operation during starting, steady state and varying insolation conditions using a developed laboratory prototype. The performance of the proposed system is also investigated under abnormal grid conditions. The proposed system performs satisfactorily under all operating condition confirming the power quality indices stated under IEEE- 519 standard, while drawing power from the grid.

### Fault Ride-Through Operation of Grid Interfaced Solar PV System with Power Quality Improvement<sup>...</sup>% '

### Author(s): Priyank Shah, Bhim Singh

**Abstract:** This treatise proposes a generalized integrator (GI) based control scheme for low voltage ride-through operation of solar photovoltaic array (SPVA) with power quality (PQ) improvement features in the distribution grid. Under balanced/unbalanced grid voltage faults, the proposed strategy controls DC-DC converter in such a way that voltage source converter (VSC) currents are achieved within its permissible limits. Moreover, according to the recommended by the revised IEEE 1547.4 standard, the SPVA coupled VSC is adaptively supplied reactive power to the grid based on depth of grid voltage sag. The GI algorithm is

proposed here to estimate accurate fundamental load component (FLC) even under the presence of DC offset. Moreover, the effectiveness of the GI algorithm is illustrated with frequency domain analysis and Lissajous plot to extract FLC. Simulation results are exhibited to illustrate the capability of the proposed strategy for the line to ground fault in the grid side network. Experimental results demonstrate the satisfactory performance under various cases such as load currents imbalancing, a variation of irradiations, SPVA-DSTATCOM mode and line to ground fault.

### Adaptive Generalized Predictive Control Scheme for Single Phase GPV System<sup>\*\*\*</sup> -

Author(s): Vedantham Lakshmi Srinivas, Bhim Singh, Sukumar Mishra Abstract: This paper proposes an adaptive generalized predictive controller (GPC) for single phase grid connected photovoltaic (GPV) system to ensure smooth active and reactive power control. Contrary to most other linear controllers, this non-linear adaptive control strategy offers quick stabilization of system parameters under variety of stochastic changes that occur in practical photovoltaic systems such as solar insolation changes, grid frequency changes, rapid perturbations in linear/ nonlinear/ induction motor loads. The developed controller has capability of providing smooth steady state and dynamic responses under such disturbances. The mathematical derivation of the controller is depicted and simulation results are provided to validate the effectiveness of the proposed control strategy. The comparative analysis depicts superior performance of the proposed controller, in comparison with linear power control strategy. With linear controllers, the injected active power is prone to constant fluctuations caused by different perturbation in solar PV system, thereby, resulting in corresponding fluctuations in DC link voltages, which increase the failure rate of electrolytic capacitors and the proposed control strategy serves as possible solution to handle the stochastic changes in PV system.

### What Changes can UM bring to UV? (Ultimate Material & Universal Village)<sup>WB#5</sup> Author(s): Sunny Wang

### **Special Session 8a: Intelligent Modeling and Simulation**

Time: 8:00am-10:30am, October 24th Location: Little Theatre(W16) Chair(s): Lin Zhang

### Discrete Event Modeling and Simulation Aspects to Improve Machine Learning Systems<sup>\*\*\*</sup>/<sub>4</sub>)

**Author(s):** Laurent Capocchi, Jean-Francois Santucci, Bernard P. Zeigler **Abstract:** Discrete Event Modeling and Simulation (M&S) and Machine Learning (ML) are two frameworks suited for system modeling which when combined can give powerful tools for system optimization for example. This paper details how discrete event M&S could be integrated into ML concepts and tools in order to improve the design and use of ML frameworks. An overview of different improvements are given and three concerning Reinforcement Learning (RL) are implemented in the framework of the DEVS formalism.

### DEVS Modeling and Simulation of Financial Leverage Effect Based on Markov Decision Process<sup>\*\*\*</sup>%%

Author(s): E. Barbieri, L. Capocchi, J.F. Santucci

Abstract: Decision making during a financial asset optimization

process leading to a potential leverage effect is a major issue in the management of an investment program such as European development programs. Modeling and simulation based on reinforcement learning can propose a decision-making policy in this kind of process. This paper presents a DEVS discrete event modeling and simulation approach from Markov decision making processes applied to the search for maximum leverage on self-financing capabilities in grant application instruction phase. The application of the approach presented in this paper is made on the search for the leverage effect linked to the price volatility of the main stock market indices (CAC40, NasDaq, etc.).

# Smart-Parking: Integration and data management by modeling and simulation using connected objects according to the DEVS formalism "% \* Author(s): Dominici Antoine, De Gentili Emmanuelle, Capocchi Laurent, Santucci Jean-Francois

**Abstract:** This paper deals with problems encountered in the current car parking. These problems can be highlighted as: few places in proportion to the need, more and more vehicles, insufficient public transport, intermodality undeveloped, uses of places not optimal linked to the payment policy and uses that evolve too slowly. A solution is proposed based on the smart city and mix smart parking with a heterogeneous solution of flow management, space availability management and transport system development involving modeling and simulation based on the DEVS (Discrete Event System specification) formalism.

### A Dynamic Data Driven Application System to Manage Urban Agricultural Ecosystems in Smart Cities<sup>11</sup>% \$

Author(s): Adam Ghandar, Georgios Theodoropoulos, Bowen Zheng, Shijie

#### Chen, Yue Gong, Miner Zhong

**Abstract:** The world is currently facing significant challenges in feeding a growing population with declining resources. Urban agriculture and vertical farming have the potential to provide a revolutionary new food supply and distribution network capable of feeding large populations in the 21st Century; as well as increase quality and reduce negative impacts on the natural environment. The concept has attracted a lot of attention from governments and business throughout the world recently. This paper describes a framework for applying technologies from Agent Based Models, Simulation and Computational Intelligence to analyze, optimize and manage "ecosystems" for urban agriculture and vertical farming for food production from the perspective of stakeholders including consumers, producers, and policy makers.

### Simulation of Production Modes for Cloud Manufacturing Enterprises "% + Author(s): Longfei Zhou, Lin Zhang, Lei Ren

Abstract: With the continuous development of new-generation information technology and new-generation artificial intelligence technoloav. the manufacturing enterprises become more autonomous and associated with each other than before. In the cloud manufacturing environment which is a kind of intelligent manufacturing model, the production modes of manufacturing enterprises are of great concern. The production modes are transforming from the traditional mass production mode to the demand-oriented mode in which the individualized product attributes are prominent. Through modeling and simulation, this paper studies the impact of different production modes on the operational efficiency of enterprises in the cloud manufacturing environment, and preliminarily explores the operating strategies and survival modes of manufacturing enterprises in the future global collaborative manufacturing environment.

#### Program Procedure Pattern Mining Model for Legacy Code<sup>\*\*\*</sup> &

Author(s): Jingjing Zhao, Jianbin Liu, Liwei Zheng

**Abstract:** Finding the program procedure patterns by manual summarization is time-consuming and laborious. A program procedure pattern mining model is proposed integrated the data mining method. The contiguous sequential pattern mining method is applied to candidate pattern mining by analyzing the procedure features. A candidate pattern classification method is proposed to classify the candidate patterns into structure candidate patterns and structure relation candidate patterns using the data flow constraint. Then use the heuristic rules to filter and abstract the functional meanings of these patterns, and finally, the program procedure patterns are obtained. The experiment system is designed to mine the legacy code and obtains more than 179 kinds of reusable program procedure patterns, verifying the effectiveness of the model.

### **Special Session 8b: Future Intelligent Manufacturing**

Time: 12:00pm-2:05pm, October 24th Location: Little Theatre(W16) Chair(s): Satarupa Mukherjee, Lin Zhang

### Integrated optimization of supplier selection and service scheduling in cloud manufacturing environment<sup>33</sup> &

Author(s): Sisi Lin, Yuanjun Laili, Yongliang Luo

**Abstract:** Cloud Manufacturing environment enables enterprises to share their resources together for rental profits and customized production. The fact that most manufacturing devices are organized and controlled in a particular production line hinders the flexible use of the corresponding services in a cloud platform. Therefore, the collaborative selection of upper layer suppliers and the underlying manufacturing services is of great importance, but rarely considered. To address the problem, a two-layer integrated model of supplier selection and service scheduling is proposed to provide feasible solutions for different kinds of production requirements. The decomposition-based multi-objective evolutionary algorithm, i.e., MOEA/D, is applied to minimize the production time, the rental cost and the transportation cost for producing a customized product. We empirically demonstrate that the integrated optimization way is more efficient than the original two-step decision way in practice.

### Machine vision for the quality assessment of emulsions in pharmaceutical processing<sup>...</sup>&%

Author(s): Saritha Unnikrishnan, John Donovan, Russell Macpherson, David Tormey

**Abstract:** Emulsion quality evaluation using machine vision techniques depends on the efficiency of the image segmentation algorithms. Two different machine vision techniques are investigated to determine their competency in detecting droplets from in-process microscopic images of a cream emulsion. Histogrambased segmentation shows promising potential compared to edge and symmetry detection. A statistical study of the droplet characteristics was conducted. The results demonstrate that the histogram-based approach is more proficient in the progressive analysis of droplet evolution during emulsification. A real-time integration of the technique is proposed, as a soft sensor, to predict the optimum process time and to increase manufacturing efficiency in chemical industries.

### A preliminary approach towards the trust issue in Cloud Manufacturing using Grounded Theory: Defining the problem domain<sup>11</sup>B#5 Author(s): Henzel Robert, Herzwurm Georg

**Abstract:** In Cloud Manufacturing trust is an important, underinvestigated issue. This paper proceeds the noncommittal phase of the grounded theory method approach by investigating the trust topic in several research streams, defining the problem domain. This novel approach fills a research gap. Findings were accomplished by a structured literature review and are able to help future researchers in pursuing the integrative phase in Grounded Theory by building on the preliminary result of this paper.

### A Manufacturing Task Scheduling Method Based on Public Goods Game on Cloud Manufacturing Model<sup>...</sup>&&

### Author(s): Tian Bai, Sicheng Liu, Lin Zhang

**Abstract:** In order to increase the resource utilization and reduce the idle in the process of implementing and running of cloud manufacturing, scheduling becomes a practical and critical issue. Different from most existing studies that focus on scenarios with intelligent optimization algorithms, this paper studies job scheduling of cloud manufacturing based on game theory, in which mathematical model of the public good game is put forward. Then, the problem of multi-job optimization of scheduling in cloud manufacturing is solved by BA Scale-free network and non-cooperative game. Finally, a numerical example is presented to demonstrate the feasibility of the approach.

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### Author(s): Chun Zhao, Lin Zhang, Xiao Luo

**Abstract:** In the process of cloud manufacturing simulation platform, the service agent drives the manufacturing service to form a self-organization network, in order to conduct transactions and cooperation spontaneously. Thus, the service network of service agent and the cooperation network of service agent are formed. In this paper, the models of two kinds of networks are created by the theory of set pair analysis, and an evaluation method for two kinds of network models is proposed. Finally, the network evaluation method is validated by simulation data.

### **Special Session 8c: Effective Microorganisms Technology**

Time: 12:00pm-2:55pm, October 24th Location: 32-370 Chair(s): Masaki Shintani

### Water quality improvement and biodiversity recovery in rivers, lakes and seas using Effective Microorganisms by citizens<sup>•••</sup>B#5

#### Author(s): Yoshiki Ito, Teruo Higa

**Abstract:** United Networks for Earth Environment (U-net) is an authorized nonprofit organization that actively solves the problem of environmental pollution, enriches the ecosystem, conserves biodiversity, and promotes the idea of coexistence using effective microorganisms (EM). The main activities of U-net are as follows: (1) supporting social contribution and environmental cleanup activities of its members such as creating a recycling-based society, promoting organic farming, and cleaning up rivers, lakes and seas using EM throughout Japan, (2) holding events and expanding the network, (3) providing public relations activities, (4) promoting environmental education such as cleaning swimming pools at school with EM, and (5) promoting projects and creating good models for the use of EM. We introduce case studies of water quality improvement and biodiversity recovery in rivers, lakes and seas using EM performed by citizens throughout the country.

# Use of EM Technology (EM) in water treatment: Urban sewage water treatment plant, a city slaughter house, and a natural estuary in Guayaquil, Ecuador<sup>...</sup>&' %

#### Author(s): Fabian Castillo

Abstract: The following article describes three case studies where Effective Microorganisms (EM) proved to be successful at recovering natural aquatic ecosystems as well as treating sewage and industrial waste water. The first case was at a water treatment plant that received the sewage water from two populated sectors of about 1'100,000 people within Guayaguil, the largest city in Ecuador. The efficacy of EM treatment was compared to an already established water treatment system using electrical aerators. In both cases, pH was maintained at a neutral range after 8 weeks and hydrogen sulfide, main cause of foul odors, was not detected after 5 weeks. The most significant difference was in the cost and used of energy. The second case consisted of treating the facilities of a slaughterhouse processing 1000 animals a day with the objective of reducing foul odors. EM was sprayed in all areas of the facility including floors, pathways, sewers and surrounding areas. Although no measurable parameters were evaluated, workers were interviewed to determine efficacy in reducing foul odors. After 5 months of treatment, employees and foremen agreed that foul odors were reduced almost completely to the point that employees did not feel the need to use masks. In addition, there was a consensus that the working conditions had significantly improved. The third case was the treatment of a natural estuary being contaminated with sewage water. Water samples and sediments were taken from the area receiving sewage water from the city sewage system. The following parameters were evaluated: Acidity, phosphates, organic matter, hydrogen sulfide, total suspended solids, populations of coliforms and salmonella. The results showed a significant decrease in phosphates, total suspended solids, organic matter and hydrogen sulfide, and a reduction in concentration of coliforms. Additionally, pH was maintained at neutral range allowing the proliferation of native life. These experiences demonstrate the versatility and efficacy of EM to mitigate water contamination due to human activities in populated cities.

### Use of EM Technology in Intensive Shrimp Aquaculture: An Effective Research-Based Tool to Enhance Sustainability<sup>...</sup>& )

Author(s): Gustavo F. Pinoargote, Toru Koshoji

Abstract: As the demand for farmed shrimp continues to grow worldwide, the use of probiotics to address the sustainability of intensive shrimp farming has gained much attention. Emerging diseases, such as acute hepatopancreatic necrosis disease (AHPND), pose a threat to sustainable intensification of shrimp aquaculture due to its devastating economic impact. This paper extends the application of Effective Microorganisms (EM) from a controlled setting to a commercial scale. A previous scientific study conducted on live shrimp evaluated the use of EM to mitigate the effects of the pathogenic V. parahaemolyticus strain that causes AHPND. In laboratory conditions, the analysis of shrimp survival and bacterial community composition in the gastrointestinal tract of shrimp showed 73.3% survival and higher weight gains (31.2%) versus the negative control (11.2%). In the present study, comparable results were obtained in a commercial shrimp farm located in Thailand, in a region where the shrimp industry had been decimated by AHPND. Survival rate increased from 58% to 91% and Food Conversion Rates decreased from 1.36 to 1.22. These results validate the efficacy of EM in inhibiting bacterial diseases and increasing the sustainability of intensive shrimp production systems.

### Use of Effective Microorganisms® (EM®) for Sustainable Pathogen Control in Food Safety.<sup>...</sup>B#5

### Author(s): Amber Gibby, Eric Lancaster

**Abstract:** TeraGanix, Inc. produces and distributes the original and certified brand, Effective Microorganisms (EM) for the United States. EM all-natural liquid probiotic comprises of three groups of microbes: Lactic Acid Bacteria, Yeast, and Photosynthetic Bacteria. Given that Lactic Acid Bacteria has been used for centuries for food preservation and fermentation, EM has the potential to be used as a biocontrol for common food-borne pathogens such as Salmonella, Listeria, and E. Coli. This paper is a gathering of research done to support EMs use in pathogen control as it relates to food safety.

Countermeasures against the radioactive contamination of agricultural crops by utilizing effective microorganisms (EM) for the agricultural land damaged in the Fukushima Daiichi nuclear power plant accident "B#5 Author(s): Shuichi Okumoto, Masaki Shintani, Aleksander Nikitin, Teruo Higa Abstract: The accident that occurred in March 2011 at the Fukushima Daiichi Nuclear Power Plant resulted in the radioactive contamination of a huge area in

the Fukushima Prefecture. Fertilization by potassium chloride is recommended and implemented for reducing the transfer of radioactive cesium from soil to the crops grown on an agricultural land. However, excessive application of potassium chloride destroys the mineral balance of the soil, possibly leading to the deterioration of the quality of crops and an increase in cost. Further, because potassium chloride cannot be used in organic agriculture, alternative techniques are required to replace chemical fertilizers. Attempts to use effective microorganisms (EM) as countermeasures against radioactive contamination began in the late 1990s at the Institute of Radiobiology (IRB) in the Republic of Belarus. The application of EM to soil suppressed the transfer of radioactive materials from the soil to the crops. Based on these observations, we have been conducting surveys, research, and demonstration tests on EM-based countermeasures against radioactive contamination in the Fukushima Prefecture since May 2011. In this report, we present the research results and on-site demonstration of the suppression of the transfer of radioactive cesium to agricultural crops by EM.

### Effective Microorganisms as a Potential Tool for the Remediation of 137Cscontaminated Soils<sup>...</sup>&(\$

Author(s): Aleksander N. Nikitin, Shuichi Okumoto, Galina Z. Gutzeva, Masaki Shintani, Galina A. Leferd, Ihar A. Cheshyk, Teruo Higa

**Abstract:** During the development of a method using effective microorganisms (EM) to reduce the soil-to-plant transfer of 137Cs on land contaminated with radioactive Cs, an unexpected effect of EM on the reduction of the 137Cs activity in soil samples was observed. Laboratory experiments were then conducted to evaluate the impact of EM and fermented organic fertilizer (EM Bokashi) on the 137Cs activity in soil samples to investigate this observation. The experimental results indicate an increase in the 137Cs decay rate of up to 4 times the theoretical decay rate corresponding to the half-life of 137Cs, which is equal to 30.17 years. Our results suggest that EM accelerates the radioactive decay of 137Cs in soil.

### Microorganisms open the future for mankind "B#5

Author(s): Teruo Higa

**Abstract:** The global environment and ecosystems are currently facing a critical situation. In order to directly address this issue and to pave a path for our future, it is essential to take a step back and redirect our focus on agriculture and microorganisms

### **Special Session 9b: Student Forum**

Time: 8:00am-2:40pm, October 24th Location: W20-307 Chair(s): Xuenan Ni, Xin Shu, Wenyang Gao, Haoran Ma

Discerning the growth pattern of water hyacinth in Lake Nokoue, Beninapplying satellite earth observation technology to inform local development "B#5 Author(s): Xuenan Ni, Ilham Ali, Danille Wood, Fohla Mouftaou Abstract: The ideas of universal village and balanced development apply to the field of using advanced space technology to inform local development in some less developed areas. The use of the satellite earth observation technology and data enables decisions based on evidence that is previously unavailable. The prototype system for observing invasive water plant species in Benin aims to support decision-making for the public and private sector. Satellite earth observation technology supports global efforts to reach the United Nations Sustainable Development Goals. This project aims specifically to support Goal #15 (Life on Land) with a focus on Target #8 to prevent the introduction and significantly reduce the impact of invasive alien species. We worked in collaboration with Green Keeper Africa - a company based in Benin which processes the invasive water hyacinth plant into a fiber that absorbs oil-based pollution. More importantly, we partnered and engaged in the design and implementation of a space-enabled monitoring system to track and model the plant's growth in West Africa.

To find out the most appropriate resolution of satellite imagery, we compared varying pixel resolution satellite imagery, acquired at 30m, 10m, and 3m imagery from NASA Landsat 8, ESA Sentinel 2, and Planet Labs' Planetscope Doves, respectively. Images were analyzed for understanding of current and historical trends of water hyacinth growth in the study region of Cotonou, Benin. To identify general aquatic vegetation, we utilized multispectral imaging satellite data and applied various techniques for analyzing visible and infrared wavelength bands: false color imaging, normalized difference vegetation index (NDVI), and classification methods like the maximum likelihood classification. By setting threshold values above 0.3 NDVI, we were able to discern dense aquatic vegetation on water bodies and generate extent maps showing historical and current trends on water hyacinth growth in Benin for about 30 years. Historical trends revealed by NDVI measurements indicated a consistent peak in water hyacinth blooms during the month of November-December. While different locations experience different peak patterns across the year.

The availability of vegetation maps helps inform community members of invasive plant blooms and aids in facilitating removal efforts. Insights from this study are widely applicable in many similar regions of the world, as water hyacinth remains invasive in nearly 80 countries.

**Real-time Learning-based Monitoring System for Water Contamination**<sup>\*\*\*</sup> **\***) **Author(s):** Qi Chen, Guanghua Cheng, Yajun Fang, Yang Liu, ZHANG Zejun, Yiyang Gao, Berthold K. P. Horn

Abstract: It is vital for a city to monitor water quality in real time since the quality of water has profound effect on residents' health. Unfortunately, it is impossible for human to monitor water's chemical composition frequently, which is an impossibly demanding task, let alone in real time. Thus, taking advantage of a highly efficient system can be an excellent solution. In this paper, we created a system called Real-time Intelligent Monitoring System for Water Quality, which enables a city to be responsive to potential outbreak of contamination and to protect city residents. The system is capable of processing and classifying the data extracted from visual images to considerably save more money and labor. In this case, two features Fast Fourier Transform (FFT) and Color Layout Descriptor (CLD) are introduced for Saliency features and color features respectively. FFT performs well in extracting saliency features and is not computationally intensive; CLD is able to represent the color features with high effectiveness and efficiency. Additionally, this system utilizes Support Vector Machine (SVM) based on such features that needs small size of training sets. trains very fast and can classify floating rubbish and any other scenarios of water pollution with satisfying efficiency. Till now, the accuracy has reached 75%, which encourages us. While the detection performance can be further improved, the efficient features & classifiers would serve as powerful methods to automatically monitor water pollution.

#### Intelligent Garbage Bin with True-False Classification "B#5

**Author(s):** Jieke Wang, Yang Liu, Cajun Fang, Berthold K.P. Horn **Abstract:** Current intelligent garbage bins like Bin-E follow process of throwing and classifying. This article proposes for a new garbage bin with a different process. Classifying, when return true for this kind, it allows people to throw; otherwise it will be close. This garbage bin, with a lower cost, can force, tutor, and instruct people, especially travelers, to deal with their garbage in public areas.

#### Transcribing Latin Manuscripts in Respect to Linguistics "" %

**Author(s):** Manqing Feng, Guoxin Huang, Chuyuan Zhang, Yang Liu, Yajun Fang, Berthold K.P. Horn

**Abstract:** Current text detection software, although can transcribe modern languages with high accuracy, has flaws detecting texts and sufficiently transcribe original Latin manuscripts. This paper focuses on establishing a system, aiming for transcribing Latin Manuscripts containing intricate abbreviations, combining basic object detection algorithms with linguistics. The method of projection was applied for image processing and algorithms are improved in respect to linguistic and topology. This paper only proposes a general approach for transcribing Latin manuscript in respect to linguistics.

### Early Detection of Esophageal Cancer Using Computer Vision<sup>•••</sup>B#5 Author(s): Peize Li

**Abstract:** Due to the proliferation of usages of artificial intelligence, my aim of this research is to detect early esophageal cancer using computer vision and deep learning. Cancer, certainly the biggest issue in medical field right now, should alarm the researchers about its solution. All the cancer diagnoses are done by cancer experts, which are human beings, before. Therefore, the incorporation of computer vision and machine learning virtually will make the diagnosis more accurate and efficient. It will vastly eliminate the morality caused by the late detections and late diagnoses. Although this design can produce independent results, it certainly needs to be only a CAD (computer-aided design). Overall, the compromise of the experts' diagnoses and the computers' diagnoses shall be made.

Video-based Fall Detection for Seniors with Human Pose Estimation ....' % Author(s): Zhanyuan Huang, Yang Liu, Yajun Fang, Berthold K. P. Horn Abstract: In recent years, aging of population and empty nest problem are becoming more and more severe. In addition, fall is the leading cause of death for seniors both in China and the U.S. Therefore, automatic fall detection for seniors is required in smart home and smart healthcare system. Currently, for its convenience and low cost, video-based method is the optimal method compared with other methods such as wearable sensor and ambient sensor in the field of indoor fall detection. In this paper, we propose a novel 2D video-based fall detection pipeline with human pose estimation. Firstly, we used OpenPose to extract the positions of human joints in raw data. Secondly, these data with augmented features became the input of a convolution neural network so that we can extract multi-layered features. Thirdly, a binary classification was conducted through neural network. For comparison, we also used SVM as the classifier. At last, we achieved relatively high sensitivity and specificity when compared our results with other state-of-the-art approaches on three public fall datasets.

### Analogical Model of Merging Process in Urban Transportation System by Application of Oblique Shockwave Theory<sup>\*\*\*</sup> %

Author(s): Kening Sun, Guangyang Che, Yaqi Li

**Abstract:** Congestion in the merging roadways cannot be neglect, and it is necessary to build merging roadways in more massive scale by addressing it. In this paper, we compare the oblique shockwave in aerodynamic with the dynamic process in the merging roadways. Besides, we present the formation of the oblique shock wave in the turning section and merging section. Based on the similar mechanics between airflow and traffic flow, a traffic oblique shockwave model is proposed to explain the mechanics between the merging stream and the stream from the upstream. With this analogical model, we can obtain more regularities of the process of merging roadways.

### An Emergency Ranking System for Intelligent Transportation Surveillance<sup>•••</sup>B#5 Author(s): Xuankai Fang

**Abstract:** The Intelligent Traffic Surveillance System which aims to enhance the quick reaction capability of the future smart city using several Computer Vision Technologies has been a hot research topic for a long time. Recent years, with the tide of the Artificial Intelligent development, new directions like using the Deep-Learning method has play a more and more significant role. This article will introduce an Intelligent Surveillance System for traffic emergency sorting. I built a traffic dataset of scenes like collision, explosion, bad weather, etc. Then I trained a neural network utilizing the Transfer Learning method and the dataset that can rank the images into different emergency levels. This system may alleviate the burden of the traffic surveillance in future smart city where a thousands of webcam needed to be focus and the city administrator can always find the situation that needs the most attention. Also, this article analyzes shortages of Deep-Learning method and make several feasible extensions which may be used to create a more impeccable system.

### A Macroscopic Traffic Simulation Model to Mingle Manually Operated and Self-driving Cars<sup>…</sup>' &&

**Author(s):** Zihan Cao, Yang Liu, Yajun Fang, Longfei Zhou, Berthold K. P. Horn **Abstract:** As the rapid development of AI, computer vision and automatic control technologies, self-driving cars have been well designed and developed. Since self-driving cars should coexist efficiently with human-driving cars, how to make practical strategies for them is increasingly significant. This paper optimizes cellular automaton to do simulation and quantizes the human factors as realistic and comprehensive as possible based on spectral clustering which is very suitable for large-scale simulation and crowd management for future smart cities. Compared with traditional analysis which record trajectories of cars, the new model employs unsupervised learning to augment average speed and reduce collision time by realizing algorithm optimization to reduce complexity and computational cost. This paper not only demonstrates the progress and results of traffic simulation, but also illustrates the concrete strategies for both self-driving cars and human drivers.

### A Crowd Simulation Model Considering Individuals' Emotion and Energy: Proposing and Assessing Management Plans<sup>•••</sup>B#5

**Author(s):** Xi Zhang, Yajun Fang, Yang Liu, Berthold K. P. Horn **Abstract:** Large aggregation of crowd often leads to dangerous situation and may harm individuals' life. We innovated classic microscopic crowd simulation model by incorporating the information of assessing people' emotion and energy status. Under this improved microscopic simulation model, this paper also explores how to assess possible crowd management plans through a percolation model with an imbedded virtual lattice structure, with adaptive properties for different situations. We applied this model with some current popular crowd management approaches and proposed new more efficient guidance plans under several particular circumstances as well.

#### Preliminary Study on Index Construction of Medical Tourism Destination "B#5 Author(s): Qikai Su, Yajun Fang, Yang Liu, Berthold K. P. Horn

**Abstract:** With the growth of global medical demand, more and more people choose to go to other countries to treat their diseases and recuperate themselves. Medical tourism presents a trend of rapid development of industrialization. The purpose of this paper is to set up a comprehensive process which can construct an index of involved medical tourism centers for tourists to choose the most suitable medical tourism destination if all required data is collected. It is gradually improved from a basic framework, with the corresponding evaluation system added. Our result shows that it is a strict five-steps procedure: Preliminary determination of independent variables, Expert intervention, Use sample data to determine final scale, Determination of alternative destinations, Use sample data to determine final index.

### Preliminary Study on Evaluation of Renewable Energy and Proposed Prediction Model and Index Analysis<sup>11</sup>B#5

**Author(s):** Jingji Zang, Yajun Fang, Yang Liu, Berthold K. P. Horn **Abstract:** The paper first studied the traditional energy sources and their challenges, then, systematically introduced alternative energy and their features. We addressed the following three questions. 1. The sustainability of the current energy. 2. The environmental pollution due to energy consumption. 3. The pro and cons of different renewable energy and their usages of renewable energy in various countries. We also proposed a prediction model and index system for energy usages which was confirmed by experiment results. The paper is expected to serve as a general guidance on the smart energy management.

### Special Session 9a&9c: City Forum & Industry

Time: 2:40pm-4:35pm, October 24th Location: W20-307 Chair(s): Tao Ma

#### Knowledge based Smart Environment<sup>\*\*\*</sup>B#5

#### Author(s): Xin Shu

**Abstract:** In the past, we regard the Earth as the liveliest place for humans to live, but many problems increasingly emerging in the planet ought to be as green as before. Environmental challenges in the world are intertwined, the first thing for us to solve the problems is to know the current status, so that we can better counter them. Recently, there is a trend that people want to combine technology with the environment to rescue our planet, and to improve the status. The most efficient way to modify the current way to benefit the environment is to learn about the state-of-the-art technologies, which is a new stage to achieve in the future – Smart City. Humanity has exploited the Earth's natural resources and modified the environment for thousands of years, but in the last two centuries human impact has increased hugely, in part because of population growth, in part because of technological changes and partly as a consequence of the way that development has been allowed to proceed. The last few decades have witnessed a growing awareness of, and concern for, environmental issues and since the mid-1980s these have been linked with calls for better approaches to development.

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Author(s): Hao Qiu, Yang Liu, Yajun Fang, Berthold K. P. Horn

**Abstract:** The rapid urbanization process has profound impact on many aspects of human beings. Many challenges and problems are shown during the process, particular in the field of safety. Thus, smart city is introduced to address these issues. This paper will focus on smart safety, one of the major components in a smart city, report current status and challenges, discuss possible interaction between smart safety and other components, and analyze the impact of smart safety system. Finally, several suggestions will be proposed to improve the effectiveness of the system.

### Evaluation of Current WMS and Proposal for Future Advancement in UV<sup>III</sup>B#5 Author(s): Shunzhi Wen

**Abstract:** Due to the rapid increase in waste accumulation in recent decades along with economic development, the waste management system attracts more and more attention around the world. This paper studies the current waste management system, explores the correlation between the effectiveness of a country's waste management system and the country's developmental conditions, introduces and evaluates how the incoming new technologies innovate the current waste management system, and finally proposes the guideline on how different countries should innovate their current waste management system and work together to solve the current environmental crisis.

### Use artificial intelligence and computer vision to reform metal scrap recycling<sup>...</sup>B#5

### Author(s): Tian Tan, Zhonghe Wang

Abstract: Metal scrap recycling industry is currently widely integrated in socioeconomic system including secondary metal commodity trading, residential and industry waste recovery and reuse, and environmental protection. While metal scrap recycling deliver the most basic needs to ensure social functioning, it comes at the cost of high society cost due to its primitive mode of operation. Scrap recycling industry has 4 key factors, identify material, match scrap with user, process material, and control pollution. Scarce labour resources and scrap knowledge become main constraints in all 4 factors of the scrap recycling industry. Accordingly, technologies, such as artificial intelligence (AI) and big data, which increase efficiency of all 4 factors to dramatically improve the recovery ratio of renewable scrap sources without sacrificing natural environment or increasing social operation cost are critical to the all-round upgrade of metal scrap recycling in modern society. This article aims to provide a comprehensive metal scrap recycling system design based on AI and big data toward the goal of enabling efficient recycling of metal scrap. Specifically, it will provide an overview of current metal scrap recycling industry, highlight key technologies, such as computer vision and MPIRAN, could be used in identifying, matching and processing, and discuss various system designs that can reform metal scrap recycling industry chain. It will also summarize various development resources that enable researchers and practitioners to quickly get started in this field, and highlight important benchmarking metrics and design considerations that should be used for evaluating the very complex metal scrap recycling system design, optionally including algorithmic code signs, being proposed in academia and industry.

#### New Paradigms, Practices and Precursors; From the Misiones Pedagógicas (MP) of the Spanish Second Republic (SSR) to Al Democracy<sup>11</sup>&) \$ Author(s): F. Bozzano-Barnes

**Abstract:** This paper addresses crucial issues, in a forum that is more qualified collectively than its author for this task. It is part of an iterative research activity that spans widely in time. It is a simple progress report. This paper is a critical overview of present and past sociotechnical change since the industrial revolution, focusing on critical processes, paradigms and practices synthetically. The idea is to explore the management of harmonious sociotechnical systems. But this will be done with an open systems approach, so the emphasis is on understanding different processes without an emphasis on logical coherence, but defining different voices and their potential impacts. Leaving the options open. Without closure, but inviting further dialogue and iterations.

### Preliminary Study on Evaluation of Smart-Cities Technologies and Proposed UV Lifestyles<sup>...</sup>&) \*

**Author(s):** Shengsheng Cao, Yanxi Chen, Guanghua Cheng, Fuxin Du, Wenyang Gao, Ziyan He, Shuqing Li, Shijun Lun, Haoran Ma, Qikai Su, Chuyuan Zhang, Tianyi Zhang, Zejun Zhang, Jie Zheng, Longfei Zhou, Yajun Fang

**Abstract:** Our current society is facing challenges in both sustainability and environmental pollution due to fast urbanization, limited resources, and increasing senior population. Smart cities which aim to increase efficiency and convenience would not be able to solve fundamental challenges caused by urban lifestyles. In 2013, the Universal Village concept was proposed to enhance human-nature harmony through prudent use of technologies and to address the eco-challenges due to fast urbanization.

This paper first studies the environmental implications due to urban lifestyles and proposes the suitable UV framework and detailed content of universal village lifestyle in order to address the eco-challenges. The paper then evaluates the development of current smart city technologies and assesses their validity with regard to the concept of Universal Village through systematic studies of several major intelligent systems.

Specifically, this paper discusses the subject of connectivity from four perspectives: feedback loop, mutual interaction, dynamic information loop, and material cycle. The paper evaluates whether information feedback loops could be formed for these major systems, and also explores the mutual interaction and dependence among the seemingly independent major systems. We discover that mutual interaction connects the aforementioned systems into an interconnected network and naturally forms dynamic information loops in which the decision of one system may be the required input of another system or vice versa. This implies that proper functioning of these systems requires extensive information sharing among them. One event might dynamically trigger different events. The last connectivity is a material cycle. We explore the whole life cycle of products, including impact from lifestyle, customers' need, product design, cloud manufacturing, sale channel, feedback collection from customers, reuse and recycling, scrapping, to final waste-disposal, etc., and study how to reduce the demand for resource and waste during the procedure. The idea is to include the perspective of UV lifestyle when designing products: considering the possibility in proactively reducing the need, sharing a product with different people, reusing product parts into the manufacturing, recycling reusable components of finished products before the products' being fully disassembled, etc. The advantage is to reduce the need for products and to avoid manufacturing the same components from raw materials directly, which demands less resource.

In summary, connectivity, as discussed from the four perspectives, would greatly contribute to the effectiveness and efficiency of our connected smart systems. Dynamic information loop helps coordinate resource allocation, decreases the collective costs, and reduces demand of natural resources from the natural environment, resulting in less damage to the environment which ultimately enhances system-wide harmony between human and its natural environment, and leads to human happiness in general.

### **UV WORKSHOPS**

Time: 10:00am-5:00pm, October 22nd Location: W20-491 Host: Tingying Zeng & Ruitao Wen

### Democratizing Intelligent Vehicle Technologies<sup>•••</sup>B#5

Kazuya Takeda

Nagoya Univ., Japan, Professor, Presidential Adviser

Time: 10:00am-10:45am

### Bioconversion of Solar Energy for UV Sustainable Enhancement<sup>11</sup>B#5

Pengcheng Fu

Hainan Univ.

Time: 10:45am-11:15am

# Design Culture on Healthy Life under the View of Ecological Civilization<sup>...</sup>' &,

Shengsheng Cao

Tsinghua Univ.

Time: 11:15am-12:00pm

### Lunch Break

Time: 12:00pm-2:00pm

### Innovative Sustainable Technologies<sup>•••</sup>B#5

Anumakonda Jagadeesh

Time: 2:00pm-2:45pm

### Smart City: An Evaluation of Blue Energy "B#5

Edgar S. Fu University of Pittsburgh Time: 2:45pm-3:15pm

### Panel Discussion: New Energy "B#5

Tingying Zeng, Ruitao Wen, Xiaoman Duan MIT

Time: 3:15pm-4:15pm

### A New Generation Multi-media Artist Living in Boston<sup>•••</sup>B#5 Wen Yu

Art Director, Build-It-Yourself Time: 4:15pm-4:45pm