

# **Network and Distributed System Security Symposium 2019**

San Diego, California, USA  
24 – 27 February 2019

Volume 1 of 2

ISBN: 978-1-7138-2196-0

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2019) by The Internet Society  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact The Internet Society  
at the address below.

The Internet Society  
11710 Plaza America Drive, Suite 400  
Reston, VA 20190  
U.S.A.

Phone: (703) 439-2120  
Fax: (703) 326-9881

[www.internetsociety.org](http://www.internetsociety.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## VOLUME 1

### **SESSION 1A: MOBILE SECURITY**

SANCTUARY: ARMING TRUSTZONE WITH USER-SPACE ENCLAVES .....	1
<i>Ferdinand Brasser, David Gens, Patrick Jauernig, Ahmad-Reza Sadeghi, Emmanuel Stapf</i>	
GINSENG: KEEPING SECRETS IN REGISTERS WHEN YOU DISTRUST THE OPERATING SYSTEM .....	16
<i>Min Hong Yun, Lin Zhong</i>	
DROIDCAP: OS SUPPORT FOR CAPABILITY-BASED PERMISSIONS IN ANDROID .....	31
<i>Abdallah Dawoud, Sven Bugiel</i>	
TIME DOES NOT HEAL ALL WOUNDS: A LONGITUDINAL ANALYSIS OF SECURITY-MECHANISM SUPPORT IN MOBILE BROWSERS .....	46
<i>Meng Luo, Pierre Laperdrix, Nima Honarmand, Nick Nikiforakis</i>	
GEO-LOCATING DRIVERS: A STUDY OF SENSITIVE DATA LEAKAGE IN RIDE-HAILING SERVICES.....	61
<i>Qingchuan Zhao, Chaoshun Zuo, Giancarlo Pellegrino, Zhiqiang Lin</i>	
PLEASE FORGET WHERE I WAS LAST SUMMER: THE PRIVACY RISKS OF PUBLIC LOCATION (META)DATA.....	76
<i>Kostas Drakonakis, Panagiotis Ilia, Sotiris Ioannidis, Jason Polakis</i>	

### **SESSION 1B: WEB SECURITY**

DON'T TRUST THE LOCALS: INVESTIGATING THE PREVALENCE OF PERSISTENT CLIENT-SIDE CROSS-SITE SCRIPTING IN THE WILD.....	91
<i>Marius Steffens, Christian Rossow, Martin Johns, Ben Stock</i>	
MASTER OF WEB PUPPETS: ABUSING WEB BROWSERS FOR PERSISTENT AND STEALTHY COMPUTATION .....	106
<i>Panagiotis Papadopoulos, Panagiotis Ilia, Michalis Polychronakis, Evangelos P. Markatos, Sotiris Ioannidis, Giorgos Vasiliadis</i>	
TRANCO: A RESEARCH-ORIENTED TOP SITES RANKING HARDENED AGAINST MANIPULATION .....	121
<i>Victor Le Pochat, Tom Van Goethem, Samaneh Tajalizadehkhoob, Maciej Korczynski, Wouter Joosen</i>	
JAVASCRIPT TEMPLATE ATTACKS: AUTOMATICALLY INFERRING HOST INFORMATION FOR TARGETED EXPLOITS.....	136
<i>Michael Schwarz, Florian Lackner, Daniel Gruss</i>	
LATEX GLOVES: PROTECTING BROWSER EXTENSIONS FROM PROBING AND REVELATION ATTACKS .....	151
<i>Alexander Sjösten, Steven Van Acker, Pablo Picazo-Sanchez, Andrei Sabelfeld</i>	

MATLS: HOW TO MAKE TLS MIDDLEBOX-AWARE? .....	166
<i>Hyunwoo Lee, Zach Smith, Junghwan Lim, Gyeongjae Choi, Selin Chun, Taejoong Chung, Ted "taekyoung" Kwon</i>	

## **SESSION 2A: BLOCKCHAIN I**

SABRE: PROTECTING BITCOIN AGAINST ROUTING ATTACKS.....	181
<i>Maria Apostolaki, Gian Marti, Jan Müller, Laurent Vanbever</i>	

A TREASURY SYSTEM FOR CRYPTOCURRENCIES: ENABLING BETTER COLLABORATIVE INTELLIGENCE .....	196
<i>Bingsheng Zhang, Roman Oliynykov, Hamed Balogun</i>	

FINE-GRAINED AND CONTROLLED REWRITING IN BLOCKCHAINS: CHAMELEON-HASHING GONE ATTRIBUTE-BASED.....	211
<i>David Derler, Kai Samelin, Daniel Slamanig, Christoph Striecks</i>	

YODA: ENABLING COMPUTATIONALLY INTENSIVE CONTRACTS ON BLOCKCHAINS WITH BYZANTINE AND SELFISH NODES .....	226
<i>Sourav Das, Vinay Joseph Ribeiro, Abhijeet Anand</i>	

GIVING STATE TO THE STATELESS: AUGMENTING TRUSTWORTHY COMPUTATION WITH LEDGERS.....	241
<i>Gabriel Kaptchuk, Matthew Green, Ian Miers</i>	

## **SESSION 2B: MALWARE AND THREATS**

CRACKING THE WALL OF CONFINEMENT: UNDERSTANDING AND ANALYZING MALICIOUS DOMAIN TAKE-DOWNS .....	256
<i>Eihal Alowaisheq, Peng Wang, Sumayah Alrwais, Xiaojing Liao, Xiaofeng Wang, Tasneem Alowaisheq, Xianghang Mi, Siyuan Tang, Baojun Liu</i>	

CLEANING UP THE INTERNET OF EVIL THINGS: REAL-WORLD EVIDENCE ON ISP AND CONSUMER EFFORTS TO REMOVE MIRAI .....	271
<i>Orçun Çetin, Carlos Gañan, Lisette Altena, Takahiro Kasama, Daisuke Inoue, Kazuki Tamiya, Ying Tie, Katsunari Yoshioka, Michel Van Eeten</i>	

MEASUREMENT AND ANALYSIS OF HAJIME, A PEER-TO-PEER IOT BOTNET .....	286
<i>Stephen Herwig, Katura Harvey, George Hughey, Richard Roberts, Dave Levin</i>	

COUNTERING MALICIOUS PROCESSES WITH PROCESS-DNS ASSOCIATION.....	301
<i>Suphannee Sivakorn, Kangkook Jee, Yixin Sun, Lauri Korts-Pärn, Zhichun Li, Cristian Lumezanu, Zhenyu Wu, Lu-An Tang, Ding Li</i>	

EXSPECTRE: HIDING MALWARE IN SPECULATIVE EXECUTION .....	316
<i>Jack Wampler, Ian Martiny, Eric Wustrow</i>	

## **SESSION 3A: ADVERSARIAL MACHINE LEARNING**

ML-LEAKS: MODEL AND DATA INDEPENDENT MEMBERSHIP INFERENCE ATTACKS AND DEFENSES ON MACHINE LEARNING MODELS.....	331
<i>Ahmed Salem, Yang Zhang, Mathias Humbert, Pascal Berrang, Mario Fritz, Michael Backes</i>	

MBEACON: PRIVACY-PRESERVING BEACONS FOR DNA METHYLATION DATA .....	346
<i>Inken Hagestedt, Yang Zhang, Mathias Humbert, Pascal Berrang, Haixu Tang, Xiaofeng Wang, Michael Backes</i>	

STEALTHY ADVERSARIAL PERTURBATIONS AGAINST REAL-TIME VIDEO CLASSIFICATION SYSTEMS.....	361
<i>Shasha Li, Ajaya Neupane, Sujoy Paul, Chengyu Song, Srikanth V. Krishnamurthy, Amit K. Roy Chowdhury, Ananthram Swami</i>	

NIC: DETECTING ADVERSARIAL SAMPLES WITH NEURAL NETWORK INVARIANT CHECKING .....	376
<i>Shiqing Ma, Yingqi Liu, Guanhong Tao, Wen-Chuan Lee, Xiangyu Zhang</i>	

TEXTBUGGER: GENERATING ADVERSARIAL TEXT AGAINST REAL-WORLD APPLICATIONS.....	391
<i>Jinfeng Li, Shouling Ji, Tianyu Du, Bo Li, Ting Wang</i>	

### **SESSION 3B-1: ENTERPRISE SECURITY**

DIGITAL HEALTHCARE-ASSOCIATED INFECTION: A CASE STUDY ON THE SECURITY OF A MAJOR MULTI-CAMPUS HOSPITAL SYSTEM .....	406
<i>Luis Vargas, Logan Blue, Vanessa Frost, Christopher Patton, Nolen Scaife, Kevin R. B. Butler, Patrick Traynor</i>	

MIND YOUR OWN BUSINESS: A LONGITUDINAL STUDY OF THREATS AND VULNERABILITIES IN ENTERPRISES.....	421
<i>Platon Kotzias, Leyla Bilge, Pierre-Antoine Vervier, Juan Caballero</i>	

NODOZE: COMBATTING THREAT ALERT FATIGUE WITH AUTOMATED PROVENANCE TRIAGE .....	436
<i>Wajih Ul Hassan, Shengjian Guo, Ding Li, Zhengzhang Chen, Kangkook Jee, Zhichun Li, Adam Bates</i>	

### **SESSION 3B-2: CENSORSHIP**

THE USE OF TLS IN CENSORSHIP CIRCUMVENTION.....	451
<i>Sergey Frolov, Eric Wustrow</i>	

ON THE CHALLENGES OF GEOGRAPHICAL AVOIDANCE FOR TOR .....	466
<i>Katharina Kohls, Kai Jansen, David Rupprecht, Thorsten Holz, Christina Pöpper</i>	

### **SESSION 4A: FUZZING**

PERISCOPE: AN EFFECTIVE PROBING AND FUZZING FRAMEWORK FOR THE HARDWARE-OS BOUNDARY .....	481
<i>Dokyung Song, Felicitas Hetzelt, Dipanjan Das, Chad Spensky, Yeoul Na, Stijn Volckaert, Giovanni Vigna, Christopher Kruegel, Jean-Pierre Seifert, Michael Franz</i>	

REDQUEEN: FUZZING WITH INPUT-TO-STATE CORRESPONDENCE .....	496
<i>Cornelius Aschermann, Sergej Schumilo, Tim Blazytko, Robert Gawlik, Thorsten Holz</i>	

NAUTILUS: FISHING FOR DEEP BUGS WITH GRAMMARS.....	511
<i>Cornelius Aschermann, Tommaso Frassetto, Thorsten Holz, Patrick Jauernig, Ahmad-Reza Sadeghi, Daniel Teuchert</i>	

ANALYZING SEMANTIC CORRECTNESS WITH SYMBOLIC EXECUTION: A CASE STUDY ON PKCS#1 V1.5 SIGNATURE VERIFICATION .....	526
<i>Sze Yiu Chau, Moosa Yahyazadeh, Omar Chowdhury, Aniket Kate, Ninghui Li</i>	

SEND HARDEST PROBLEMS MY WAY: PROBABILISTIC PATH PRIORITIZATION FOR HYBRID FUZZING.....	541
<i>Lei Zhao, Yue Duan, Heng Yin, Jifeng Xuan</i>	

**SESSION 4B: PRIVACY ON THE WEB**

MEASURING THE FACEBOOK ADVERTISING ECOSYSTEM.....	556
<i>Athanasios Andreou, Márcio Silva, Fabrício Benevenuto, Oana Goga, Patrick Loiseau, Alan Mislove</i>	

WE VALUE YOUR PRIVACY ... NOW TAKE SOME COOKIES: MEASURING THE GDPR'S IMPACT ON WEB PRIVACY .....	571
<i>Martin Degeling, Christine Utz, Christopher Lentzsch, Henry Hosseini, Florian Schaub, Thorsten Holz</i>	

HOW BAD CAN IT GET? CHARACTERIZING SECRET LEAKAGE IN PUBLIC GITHUB REPOSITORIES .....	586
<i>Michael Meli, Matthew R. McNiece, Bradley Reaves</i>	

DNS CACHE-BASED USER TRACKING .....	601
<i>Amit Klein, Benny Pinkas</i>	

QUANTITY VS. QUALITY: EVALUATING USER INTEREST PROFILES USING AD PREFERENCE MANAGERS.....	616
<i>Muhammad Ahmad Bashir, Umar Farooq, Maryam Shahid, Muhammad Fareed Zaffar, Christo Wilson</i>	

**SESSION 5A: BUGS AND VULNERABILITIES**

THUNDERCLAP: EXPLORING VULNERABILITIES IN OPERATING SYSTEM IOMMU PROTECTION VIA DMA FROM UNTRUSTWORTHY PERIPHERALS.....	631
<i>A. Theodore Marketos, Colin Rothwell, Brett F. Gutstein, Allison Pearce, Peter G. Neumann, Simon W. Moore, Robert N. M. Watson</i>	

ONE ENGINE TO SERVE 'EM ALL: INFERRING TAIN'T RULES WITHOUT ARCHITECTURAL SEMANTICS .....	646
<i>Zheng Leong Chua, Yanhao Wang, Teodora Baluta, Prateek Saxena, Zhenkai Liang, Purui Su</i>	

**VOLUME 2**

AUTOMATING PATCHING OF VULNERABLE OPEN-SOURCE SOFTWARE VERSIONS IN APPLICATION BINARIES .....	661
<i>Ruian Duan, Ashish Bijlani, Yang Ji, Omar Alrawi, Yiyuan Xiong, Moses Ike, Brendan Saltaformaggio, Wenke Lee</i>	

CRCOUNT: POINTER INVALIDATION WITH REFERENCE COUNTING TO MITIGATE USE-AFTER-FREE IN LEGACY C/C+ .....	676
<i>Jangseop Shin, Donghyun Kwon, Jiwon Seo, Yeongpil Cho, Yunheung Paek</i>	

CODEALCHEMIST: SEMANTICS-AWARE CODE GENERATION TO FIND VULNERABILITIES IN JAVASCRIPT ENGINES .....	691
<i>Hyungseok Han, Donghyeon Oh, Sang Kil Cha</i>	

### **SESSION 5B: SIDE CHANNELS**

OLIGO-SNOOP: A NON-INVASIVE SIDE CHANNEL ATTACK AGAINST DNA SYNTHESIS MACHINES .....	706
<i>Sina Faezi, Sujit Rokka Chhetri, Arnav Vaibhav Malawade, John Charles Chaput, William Grover, Philip Brisk, Mohammad Abdullah Al Faruque</i>	

PROFIT: DETECTING AND QUANTIFYING SIDE CHANNELS IN NETWORKED APPLICATIONS.....	721
<i>Nicolás Rosner, Ismet Burak Kadron, Lucas Bang, Tevfik Bultan</i>	

UNVEILING YOUR KEYSTROKES: A CACHE-BASED SIDE-CHANNEL ATTACK ON GRAPHICS LIBRARIES.....	736
<i>Daimeng Wang, Ajaya Neupane, Zhiyun Qian, Nael Abu-Ghazaleh, Srikanth V. Krishnamurthy, Edward J. M. Colbert, Paul Yu</i>	

DATA OBLIVIOUS ISA EXTENSIONS FOR SIDE CHANNEL-RESISTANT AND HIGH PERFORMANCE COMPUTING.....	751
<i>Jiyong Yu, Lucas Hsiung, Mohamad El'Hajj, Christopher W. Fletcher</i>	

PRIVACY ATTACKS TO THE 4G AND 5G CELLULAR PAGING PROTOCOLS USING SIDE CHANNEL INFORMATION .....	766
<i>Syed Rafiul Hussain, Mitziu Echeverria, Omar Chowdhury, Ninghui Li, Elisa Bertino</i>	

### **SESSION 6A: AUTHENTICATION**

COCONUT: THRESHOLD ISSUANCE SELECTIVE DISCLOSURE CREDENTIALS WITH APPLICATIONS TO DISTRIBUTED LEDGERS .....	781
<i>Alberto Sonnino, Mustafa Al-Bassam, Shehar Bano, Sarah Meiklejohn, George Danezis</i>	

DISTINGUISHING ATTACKS FROM LEGITIMATE AUTHENTICATION TRAFFIC AT SCALE .....	796
<i>Cormac Herley, Stuart Schechter</i>	

ROBUST PERFORMANCE METRICS FOR AUTHENTICATION SYSTEMS .....	809
<i>Shridatt Sugrim, Can Liu, Meghan McLean, Janne Lindqvist</i>	

TOTAL RECALL: PERSISTENCE OF PASSWORDS IN ANDROID .....	824
<i>Jaeho Lee, Ang Chen, Dan S. Wallach</i>	

HOW TO END PASSWORD REUSE ON THE WEB .....	839
<i>Ke Coby Wang, Michael K. Reiter</i>	

### **SESSION 6B: PROTOCOL SECURITY**

COMPONENT-BASED FORMAL ANALYSIS OF 5G-AKA: CHANNEL ASSUMPTIONS AND SESSION CONFUSION .....	854
<i>Cas Cremers, Martin Dehnel-Wild</i>	

UWB WITH PULSE REORDERING: SECURING RANGING AGAINST RELAY AND PHYSICAL-LAYER ATTACKS.....	869
<i>Mridula Singh, Patrick Leu, Srdjan Capkun</i>	
NEARBY THREATS: REVERSING, ANALYZING, AND ATTACKING GOOGLE'S 'NEARBY CONNECTIONS' ON ANDROID .....	884
<i>Daniele Antonioli, Nils Ole Tippenhauer, Kasper B. Rasmussen</i>	
BADBLUETOOTH: BREAKING ANDROID SECURITY MECHANISMS VIA MALICIOUS BLUETOOTH PERIPHERALS .....	898
<i>Fenghao Xu, Wenrui Diao, Zhou Li, Jiongyi Chen, Kehuan Zhang</i>	
UNDERSTANDING OPEN PORTS IN ANDROID APPLICATIONS: DISCOVERY, DIAGNOSIS, AND SECURITY ASSESSMENT .....	913
<i>Daoyuan Wu, Debin Gao, Rocky K. C. Chang, En He, Eric K. T. Cheng, Robert H. Deng</i>	

### **SESSION 7A: IOT AND CPS**

IOTGUARD: DYNAMIC ENFORCEMENT OF SECURITY AND SAFETY POLICY IN COMMODITY IOT .....	927
<i>Z. Berkay Celik, Gang Tan, Patrick McDaniel</i>	
RFDIDS: RADIO FREQUENCY-BASED DISTRIBUTED INTRUSION DETECTION SYSTEM FOR THE POWER GRID.....	942
<i>Tohid Shekari, Christian Bayens, Morris Cohen, Lukas Graber, Raheem Beyah</i>	
A SYSTEMATIC FRAMEWORK TO GENERATE INVARIANTS FOR ANOMALY DETECTION IN INDUSTRIAL CONTROL SYSTEMS .....	957
<i>Cheng Feng, Venkata Reddy Palleti, Aditya Mathur, Deeph Chana</i>	
DIAT: DATA INTEGRITY ATTESTATION FOR RESILIENT COLLABORATION OF AUTONOMOUS SYSTEMS.....	972
<i>Tigist Abera, Raad Bahmani, Ferdinand Brassler, Ahmad Ibrahim, Ahmad-Reza Sadeghi, Matthias Schunter</i>	
ICSREF: A FRAMEWORK FOR AUTOMATED REVERSE ENGINEERING OF INDUSTRIAL CONTROL SYSTEMS BINARIES .....	987
<i>Anastasis Keliris, Michail Maniatakos</i>	

### **SESSION 7B: CRYPTO AND PRIVACY**

BALANCING IMAGE PRIVACY AND USABILITY WITH THUMBNAIL-PRESERVING ENCRYPTION.....	1002
<i>Kimia Tajik, Akshith Gunasekaran, Rhea Dutta, Brandon Ellis, Rakesh B. Bobba, Mike Rosulek, Charles V. Wright, Wu-Chi Feng</i>	
CONCURORAM: HIGH-THROUGHPUT STATELESS PARALLEL MULTI-CLIENT ORAM .....	1017
<i>Anrin Chakraborti, Radu Sion</i>	
RORAM: EFFICIENT RANGE ORAM WITH $O(\log^2 N)$ LOCALITY .....	1032
<i>Anrin Chakraborti, Adam J. Aviv, Seung Geol Choi, Travis Mayberry, Daniel S. Roche, Radu Sion</i>	
STATISTICAL PRIVACY FOR STREAMING TRAFFIC .....	1047
<i>Xiaokuan Zhang, Jihun Hamm, Michael K. Reiter, Yinqian Zhang</i>	



PRIVATE CONTINUAL RELEASE OF REAL-VALUED DATA STREAMS .....	1062
<i>Victor Perrier, Hassan Jameel Asghar, Dali Kaafar</i>	

## **SESSION 8: ATTACKS ON SPEECH RECOGNITION**

PRACTICAL HIDDEN VOICE ATTACKS AGAINST SPEECH AND SPEAKER RECOGNITION SYSTEMS .....	1075
<i>Hadi Abdullah, Washington Garcia, Christian Peeters, Patrick Traynor, Kevin R. B. Butler, Joseph Wilson</i>	

ADVERSARIAL ATTACKS AGAINST AUTOMATIC SPEECH RECOGNITION SYSTEMS VIA PSYCHOACOUSTIC HIDING .....	1090
<i>Lea Schönherr, Katharina Kohls, Steffen Zeiler, Thorsten Holz, Dorothea Kolossa</i>	

THE CRUX OF VOICE (IN)SECURITY: A BRAIN STUDY OF SPEAKER LEGITIMACY DETECTION.....	1105
<i>Ajaya Neupane, Nitesh Saxena, Leanne Hirshfield, Sarah Elaine Bratt</i>	

LIFE AFTER SPEECH RECOGNITION: FUZZING SEMANTIC MISINTERPRETATION FOR VOICE ASSISTANT APPLICATIONS .....	1119
<i>Yangyong Zhang, Lei Xu, Abner Mendoza, Guangliang Yang, Phakpoom Chinprutthiwong, Guofei Gu</i>	

## **SESSION 9: BLOCKCHAIN II**

CYBERCRIMINAL MINDS: AN INVESTIGATIVE STUDY OF CRYPTOCURRENCY ABUSES IN THE DARK WEB.....	1134
<i>Seunghyeon Lee, Changhoon Yoon, Heedo Kang, Yeonkeun Kim, Yongdae Kim, Dongsu Han, Soeul Son, Seungwon Shin</i>	

VAULT: FAST BOOTSTRAPPING FOR THE ALGORAND CRYPTOCURRENCY .....	1149
<i>Derek Leung, Adam Suhl, Yossi Gilad, Nikolai Zeldovich</i>	

SEREUM: PROTECTING EXISTING SMART CONTRACTS AGAINST RE-ENTRANCY ATTACKS .....	1164
<i>Michael Rodler, Wenting Li, Ghassan O. Karame, Lucas Davi</i>	

ANONYMOUS MULTI-HOP LOCKS FOR BLOCKCHAIN SCALABILITY AND INTEROPERABILITY .....	1179
<i>Giulio Malavolta, Pedro Moreno-Sanchez, Clara Schneidewind, Aniket Kate, Matteo Maffei</i>	

CONSTRUCTING AN ADVERSARY SOLVER FOR EQUIHASH.....	1194
<i>Xiaofei Bai, Jian Gao, Chenglong Hu, Liang Zhang</i>	

## **SESSION 10: TRUSTED EXECUTION**

OBFUSCURO: A COMMODITY OBFUSCATION ENGINE ON INTEL SGX .....	1205
<i>Adil Ahmad, Byunggill Joe, Yuan Xiao, Yinqian Zhang, Insik Shin, Byoungyoung Lee</i>	

TEE-AIDED WRITE PROTECTION AGAINST PRIVILEGED DATA TAMPERING.....	1220
<i>Lianying Zhao, Mohammad Mannan</i>	

TIMBER-V: TAG-ISOLATED MEMORY BRINGING FINE-GRAINED ENCLAVES TO RISC-V .....	1235
<i>Samuel Weiser, Mario Werner, Ferdinand Brassler, Maja Malenko, Stefan Mangard, Ahmad-Reza Sadeghi</i>	

ESTABLISHING SOFTWARE ROOT OF TRUST UNCONDITIONALLY .....	1250
<i>Virgil D. Gligor, Maverick S. L. Woo</i>	

## **SESSION 11: MACHINE LEARNING & GAME THEORY APPLICATIONS**

GRAPH-BASED SECURITY AND PRIVACY ANALYTICS VIA COLLECTIVE CLASSIFICATION WITH JOINT WEIGHT LEARNING AND PROPAGATION .....	1265
<i>Binghui Wang, Jinyuan Jia, Neil Zhenqiang Gong</i>	

ENEMY AT THE GATEWAYS: CENSORSHIP-RESILIENT PROXY DISTRIBUTION USING GAME THEORY .....	1280
<i>Milad Nasr, Sadegh Farhang, Amir Houmansadr, Jens Grossklags</i>	

NEURO-SYMBOLIC EXECUTION: AUGMENTING SYMBOLIC EXECUTION WITH NEURAL CONSTRAINTS .....	1295
<i>Shen Shiqi, Shweta Shinde, Soundarya Ramesh, Abhik Roychoudhury, Prateek Saxena</i>	

NEURAL MACHINE TRANSLATION INSPIRED BINARY CODE SIMILARITY COMPARISON BEYOND FUNCTION PAIRS .....	1310
<i>Fei Zuo, Xiaopeng Li, Patrick Young, Lannan Luo, Qiang Zeng, Zhixin Zhang</i>	

### **Author Index**