

# **2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW 2018)**

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## Women in Computer Vision

- WiCV 2018: The Fourth Women in Computer Vision Workshop .1941.....  
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- Encapsulating the Impact of Transfer Learning, Domain Knowledge and Training Strategies in Deep-Learning Based Architecture: A Biometric Based Case Study .1947.....  
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- Cross-Domain Fashion Image Retrieval .1950.....  
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- Word Spotting in Scene Images Based on Character Recognition .1953.....  
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- A Holistic Framework for Addressing the World Using Machine Learning .1956.....  
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- I Know How You Feel: Emotion Recognition with Facial Landmarks .1959.....  
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- Early Diagnosis of Alzheimer's Disease: A Neuroimaging Study with Deep Learning Architectures .1962.....  
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- Cosmetic Features Extraction by a Single Image Makeup Decomposition .1965.....  
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- Automatic Large-Scale 3D Building Shape Refinement Using Conditional Generative Adversarial Networks.1968  
*Ksenia Bittner (German Aerospace Center - DLR Munich) and Marco Körner (Technical University of Munich Munich)*
- SAM: Pushing the Limits of Saliency Prediction Models .1971.....  
*Marcella Cornia (University of Modena and Reggio Emilia), Lorenzo Baraldi (University of Modena and Reggio Emilia), Giuseppe Serra (University of Udine), and Rita Cucchiara (University of Modena and Reggio Emilia)*

- RPIfield: A New Dataset for Temporally Evaluating Person Re-identification .1974.....  
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- Large-Scale Ecological Analyses of Animals in the Wild Using Computer Vision .1977.....  
*Mikayla Timm (University of Massachusetts Amherst), Subhransu Maji (University of Massachusetts Amherst), and Todd Fuller (University of Massachusetts Amherst)*
- Discovering Style Trends Through Deep Visually Aware Latent Item Embeddings .1980.....  
*Murium Iqbal (Overstock.com), Adair Kovac (Overstock.com), and Kamelia Aryafar (Overstock.com)*
- Towards More Accurate Radio Telescope Images .1983.....  
*Nezihe Merve Gürel (ETH Zurich, Switzerland), Paul Hurley (IBM Research Zurich, Switzerland), and Matthieu Simeoni (IBM Research Zurich, Switzerland)*
- ARC: Adversarial Robust Cuts for Semi-Supervised and Multi-label Classification .1986.....  
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- ViS-HuD: Using Visual Saliency to Improve Human Detection with Convolutional Neural Networks .1989....  
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- Learning Biomimetic Perception for Human Sensorimotor Control .1998.....  
*Masaki Nakada (University of California, Los Angeles), Honglin Chen (University of California, Los Angeles), and Demetri Terzopoulos (University of California, Los Angeles)*
- Assessing Shape Bias Property of Convolutional Neural Networks .2004.....  
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- Deep-BCN: Deep Networks Meet Biased Competition to Create a Brain-Inspired Model of Attention Control .2013.....  
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