

Best Paper Section IEEE International Conference on Automatic Face and Gesture Recognition 2021

THE IEEE International Conference on Automatic Face and Gesture Recognition (FG) is the premier international conference on vision-based automatic face and body behavior analysis and applications. Since the first meeting in Zurich in 1994, the FG conference has grown from a biennial conference to an annual meeting, presenting the advancements and latest research developments related to face and gesture analysis. FG2021 was planned to be an in-person meeting hosted in the historic city of Jodhpur, India. However, due to the COVID-19 pandemic situation, the organizing committee decided to hold FG2021 as an online conference from December 15 to 18, 2021. Over 142 papers were presented at FG2021 and based on the reviewers and area chair recommendations, PC Chairs invited a set of top reviewed papers as part of a special issue on “Best of Face & Gesture 2021” in the IEEE TRANSACTIONS ON BIOMETRICS, BEHAVIOR, AND IDENTITY SCIENCE (T-BIOM). The meticulous review process of T-BIOM ensured that significantly extended research papers that were initially presented at FG2021 are included in this special issue. The nine accepted papers can be classified into three sets: (i) algorithms with 3D information based face/motion processing, (ii) algorithms towards head pose estimation, emotion recognition, differentiable rendering, dictionary attacks, and group detection, and (iii) the student engagement dataset for affect transfer learning for behavior prediction.

The first set of papers focus on harnessing 3D/RGB-D data for face reconstruction, recognition, motion prediction. Zhou et al. [A1] have proposed RADAN: replay attention and data augmentation network for 3D dense alignment and face reconstruction. In the next paper, Chopin et al. [A2] have proposed to exploit compact manifold-valued representation for human motion prediction. In addition, a predictive manifold-aware WGAN is proposed for motion prediction and a new loss function based on Gram matrix of the 3D poses that avoids predicting implausible poses. Chiu et al. [A3] have proposed DepthNet: a novel depth estimation CNN model which includes semantic segmentation. Utilizing Depthnet, three well-designed objective functions are proposed to learn a discriminative representation for the RGB-D face recognition task.

In the second set of the papers, Kuhnke and Ostermann [A4] have proposed relative pose consistency, a novel extension to consistency regularization for pose regression problems.

Praveen et al. [A5] have proposed an emotion recognition algorithm using Joint Cross-Attention for Audio-Visual Fusion. Rochette et al. [A6] have proposed a novel rendering primitive to enable the synthesis of highly realistic images of known individuals from arbitrary poses and views via a decoder network. Friedlander et al. [A7] have proposed an evolutionary algorithm in the latent embedding space of the StyleGAN face generator to generate 2D and 3D master faces for dictionary attacks. Schmuck and Celiktutan [A8] have proposed iGROWL, i.e., Group Detection With Link Prediction, for detecting interaction groups in social scenes based on a GNN that combines representation learning and link prediction.

Finally, in the third set, Ruiz et al. [A9] have presented MathSpringSP+—a student engagement dataset, and ATLB model for affect transfer learning for behavior prediction. Availability of such a dataset can enable the researchers to develop intelligent tutor assistance systems which can help in increased student engagement and interactions.

We would like to express our sincere thanks to the FG2021 Area Chairs, Technical Program Committee members, and the T-BIOM reviewers who gave their time and expertise generously. Special acknowledgement to Prof. Nalini Ratha, T-BIOM EiC and the support staff members involved in the production of this special issue. Last but by no means least, we thank all authors who have shared their exciting research findings and progress at the conference and in this special issue.

With warmest wishes!

APPENDIX: RELATED ARTICLES

- [A1] Z. Zhou, L. Li, S. Wu, X. Li, K. Ma, and X. Zhang, “Replay attention and data augmentation network for 3D face and object reconstruction,” *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 308–320, Jul. 2023.
- [A2] B. Chopin, N. Otberdout, M. Daoudi, and A. Bartolo, “3-D skeleton-based human motion prediction with manifold-aware GAN,” *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 321–333, Jul. 2023.
- [A3] M.-T. Chiu, H.-Y. Cheng, C.-Y. Wang, and S.-H. Lai, “RGB-D face recognition with identity-style disentanglement and depth augmentation,” *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 334–347, Jul. 2023.
- [A4] F. Kuhnke and J. Ostermann, “Domain adaptation for head pose estimation using relative pose consistency,” *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 348–359, Jul. 2023.
- [A5] R. Gnana Praveen, P. Cardinal, and E. Granger, “Audio-visual fusion for emotion recognition in the valence-arousal space using joint cross-attention,” *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 360–373, Jul. 2023.
- [A6] G. Rochette, C. Russell, and R. Bowden, “Novel view synthesis of humans using differentiable rendering,” *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 374–384, Jul. 2023.

- [A7] T. Friedlander, R. Shmelkin, and L. Wolf, "Generating 2-D and 3-D master faces for dictionary attacks with a network-assisted latent space evolution," *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 385–399, Jul. 2023.
- [A8] V. Schmuck and O. Celiktutan, "iGROWL: Improved group detection with link prediction," *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 400–410, Jul. 2023.
- [A9] N. Ruiz et al., "ATL-BP: A student engagement dataset and model for affect transfer learning for behavior prediction," *IEEE Trans. Biom., Behav., Ident. Sci.*, vol. 5, no. 3, pp. 411–424, Jul. 2023.

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Rachael E. Jack is a Professor of Computational Social Cognition with the School of Psychology and Neuroscience, University of Glasgow. Her research has produced significant advances in understanding facial expression of emotion within and across cultures using a novel interdisciplinary approach that combines psychophysics, social psychology, dynamic 3-D computer graphics, and mathematical psychology. She is a recipient of the American Psychological Association New Investigator Award, the Social and Affective Neuroscience Society Innovation Award, the British Psychological Society Spearman Medal, the Association for Psychological Science Rising Star Award, and International Society for Research on Emotion Young Researcher Spotlight. She is a Fellow of the Association for Psychological Science.



Vishal M. Patel is an Associate Professor of Electrical and Computer Engineering with Johns Hopkins University. His research interests are focused on biomedical image analysis, biometrics, computer vision, machine learning, and signal and image processing. He has received a number of awards, including the 2021 IEEE Signal Processing Society Pierre-Simon Laplace Early Career Technical Achievement Award, the 2021 NSF CAREER Award, the 2021 IAPR Young Biometrics Investigator Award, the 2016 ONR Young Investigator Award, the 2016 Jimmy Lin Award for Invention, and the A. Walter Tyson Assistant Professorship Award. He is an Associate Editor of the *IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE* and serves on the Machine Learning for Signal Processing Committee of the IEEE Signal Processing Society. He has also served as the Vice President of Conferences for the IEEE Biometrics Council.



Pavan Turaga is a Professor with the School of Arts, Media and Engineering, and the School of Electrical, Computer and Energy Engineering, Arizona State University. He is also the Director (ACD) of the School of Arts Media and Engineering and the Herberger Institute for Design and the Arts. His research spans representational foundations for structured and unstructured data, including time-series, image, video, 3-D point clouds and more, and their applications in areas, such as interactive systems, machine learning, computer vision, and mobile-health. He received the National Science Foundation's CAREER Award in 2015 and several Best Paper awards. He has been the founding Co-Chair of the "Differential Geometry in Computer Vision and Machine Learning" workshop series. He was an Associate Editor of the *IEEE TRANSACTIONS ON IMAGE PROCESSING* from 2018 to 2021 and the *Pattern Recognition* (Elsevier) from 2016 to 2018.



Mayank Vatsa (Fellow, IEEE) is a Professor with the Department of Computer Science and Engineering, IIT Jodhpur, India. His areas of interest are machine learning, deep learning, computer vision, and biometrics. He is a recipient of the Prestigious Swarnajayanti Fellowship from the Government of India. He has also served as an Associate Editor of *Information Fusion* and *Pattern Recognition*, the General Co-Chair of IJCB 2020, the PC co-chair and the area chair of the several conferences. From 2015 to 2018, he served as the Vice President (Publications) of the IEEE Biometrics Council, where he led the efforts to start the IEEE TRANSACTIONS ON BIOMETRICS, BEHAVIOR, AND IDENTITY SCIENCE. He has also participated in several Indian government initiatives including UIDAI (Aadhaar), designing biometrics Standards for e-Gov applications, Responsible AI, DigiYatra, and formation of TIH of Computer Vision and ARVR at IIT Jodhpur. He is a Fellow of IAPR.



Rama Chellappa (Life Fellow, IEEE) is a Bloomberg Distinguished Professor of Electrical and Computer Engineering and Biomedical Engineering and a Chief Scientist with the Johns Hopkins Institute for Assured Autonomy. He is a Pioneer in the area of artificial intelligence. His work in computer vision, pattern recognition, and machine learning have had a profound impact on areas including biometrics, smart cars, forensics, and 2-D and 3-D modeling of faces, objects, and terrain. His work in motion capturing and imaging shows promise for future use in health care and medicine. He is the 2020 recipient of the Jack S. Kilby Signal Processing Medal for his contributions to image and video processing, particularly face recognition. This is one of the top honors from IEEE and previously served as the Editor-in-Chief of IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE. He was elected to National Academy of Engineering in 2023.



Alex (Sandy) Pentland directs MIT Connection Science, an MIT-wide initiative, and previously helped create and direct the MIT Media Lab and the Media Lab Asia in India. He is one of the most-cited computational scientists in the world, and Forbes declared him one of the “seven most powerful data scientists in the world” along with Google founders and the Chief Technical Officer of the U.S. He is on the Board of the UN Foundations’ Global Partnership for Sustainable Development Data, co-led the World Economic Forum discussion in Davos that led to the EU privacy regulation GDPR, and was one of the UN Secretary General’s “Data Revolutionaries” helping to forge the transparency and accountability mechanisms in the UN’s Sustainable Development Goals. He has received numerous awards and prizes, such as the McKinsey Award from Harvard Business Review, the 40th Anniversary of the Internet from DARPA, and the Brandeis Award for work in privacy.



Richa Singh (Fellow, IEEE) is a Professor with the Department of Computer Science and Engineering, IIT-Jodhpur. Her areas of interest are pattern recognition, machine learning, and biometrics. She is a recipient of several best paper and best poster awards in international conferences. She has delivered keynote talks/tutorials on deep learning, trusted AI, domain adaptation, and biometrics. She has also served as an Associate Editor-in-Chief of *Pattern Recognition*, the General Co-Chair or the Program Co-Chair of prestigious conferences such as IJCB2024, CVPR2022, ICM2022, FG2021, and IJCB2020. She was also the Vice President (Publications) of the IEEE Biometrics Council. She has contributed in several large scale project initiatives including India’s Aadhaar project and e-gov standards for biometrics in India. She is a Fellow of IAPR.