

it is the first open dataset from the new generation acoustic/video rain gauges available for evaluating the estimated rainfall performance. We hope that this new open dataset will encourage a comparison of rainfall estimation/classification algorithms on this common database so that the adopted techniques are objectively assessed and improved. We finally hope that other research groups will contribute to future releases of AVDB-4RC or will release their datasets to the research community for future systems to be tested on open corpora of rainfall sounds/video, increasing the validity of each new scientific result obtained. The audio-video dataset is freely downloadable from the following link: <https://github.com/vicosystems/AVDB-4RC>.

REFERENCES

- [1] J.M. Trabal, and D.J. McLaughlin, "Rainfall Estimation and Rain Gauge Comparison For X-Band Polarimetric CASA Radars," in *Proc. IEEE International Geoscience and Remote Sensing Symposium*, 2017, pp. 2726-2729.
- [2] D. Nagel, "Detection of Rain Areas with Airborne Radar," in *Proc. 18th International Radar Symposium (IRS)*, 2017, pp. 1-7.
- [3] A. K. Shukla, C.S.P. Ojha, and R. D. Garg, "Comparative Study of TRMM Satellite Predicted Rainfall Data with Rain Gauge Data Over Himalayan Basin," in *Proc. IEEE International Geoscience and Remote Sensing Symposium (IGRSS)*, 2018, pp. 9347-9350.
- [4] A. K. Varma, "Measurement of Precipitation from Satellite Radiometers (Visible, Infrared, and Microwave): Physical Basis, Methods, and Limitations," *Remote Sensing of Aerosols, Clouds, and Precipitation*, pp. 223-248, 2018.
- [5] F. Beritelli, G. Capizzi, G. Lo Sciuto, F. Scaglione, D. Połap, and M. Woźniak, "A Neural Network Pattern Recognition Approach to Automatic Rainfall Classification by Using Signal Strength in LTE/4G Networks," in *Proc. International Joint Conference on Rough Sets*, 2017, pp. 505-512.
- [6] F. Beritelli, G. Capizzi, G. Lo Sciuto, C. Napoli, and F. Scaglione, "Rainfall estimation based on the intensity of the received signal in a LTE/4G mobile terminal by using a probabilistic neural network," *IEEE Access*, vol. 6, pp. 30865-30873, May 2018.
- [7] R. Avanzato, F. Beritelli, F. Di Franco, and V.F. Puglisi, "A Convolutional Neural Networks approach to Audio Classification for Rainfall Estimation," in *Proc. 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications*, 2019, pp. 285-289.
- [8] A. Gupta, A. Bansal, R. Gupta, D. Naryani, and A. Sood, "Urban Waterlogging Detection and Severity Prediction Using Artificial Neural Networks," in *Proc. IEEE 19th International Conference on High Performance Computing and Communications; IEEE 15th International Conference on Smart City; IEEE 3rd International Conference on Data Science and Systems (HPCC/SmartCity/DSS)*, 2017, pp. 42-49.
- [9] A. H. Manek, and P.K. Singh, "Comparative Study of Neural Network Architectures for Rainfall Prediction," in *Proc. IEEE Technological Innovations in ICT for Agriculture and Rural Development (TIAR)*, 2016, pp. 171-174.
- [10] F. Beritelli, and A. Spadaccini, "Statistical Approach to Biometric Identity Verification based on Heart Sounds," in *Proc. Fourth International Conference on Emerging Security Information, Systems and Technologies*, 2010, pp. 93-96.
- [11] F. Beritelli, and A. Spadaccini, "The Role of Voice Activity Detection in Forensic Speaker Verification," in *Proc. 17th IEEE International Conference on Digital Signal Processing (DSP)*, 2011.
- [12] W. Dai, C. Dai, S. Qu, J. Li, and S. Das, "Very Deep Convolutional Neural Network for Raw Waveforms," in *Proc. IEEE International Conference on Acoustics Speech and Signal Processing (ICASSP)*, 2017.
- [13] S. Sawant, and P. A. Ghonge, "Estimation of rain drop analysis using image processing, electronics and telecommunication," *International Journal of Science and Research (IJSR)*, vol. 4, pp. 1981-1986, Jan. 2015.
- [14] P. Bacche, S. Basantani, P. Deshpande, J. Joshi, and R. Bhalwankar, "Measurement of raindrop parameters using image processing," *International Journal of Innovative and Emerging Research in Engineering*, vol. 3, pp. 41-46, 2016.
- [15] K. H. V. Reddy, S.M. Basha, and J. Srinivasulu, "A simple approach for efficient detection and estimation of drops during the rainfall," *IJISSET - International Journal of Innovative Science, Engineering & Technology*, vol. 2, no. 10, pp. 203-207, Oct. 2015.
- [16] F. Nashashibi, R. De Charette, and A. Lia, "Detection of Unfocused Raindrops on a Windscreen using Low Level Image Processing," in *Proc. 11th International Conference on Control Automation Robotics & Vision*, 2010.
- [17] R. Avanzato, and F. Beritelli, "An Innovative Acoustic Rain Gauge Based on Convolutional Neural Networks," *MDPI Information*, vol. 11, no. 4, pp. 183, March 2020.
- [18] Smaniotta. [Online]. Available. <http://www.smaniotta.eu/scale-della-natura.html>.
- [19] F. Beritelli, A. Gallotta, and C. Rametta "A Dual Streaming Approach for Speech Quality Enhancement of VoIP Service Over 3G Networks," in *Proc. IEEE International Conference on Digital Signal Processing (DSP)*, 2013.
- [20] C. Chen, Y. Tock, and S. Girdzijauskas, "BeaConvey: Co-Design of Overlay and Routing for Topic-based Publish/Subscribe on Small-World Networks," in *Proc. 12th ACM International Conference on Distributed and Event-based Systems*, 2018, pp. 64-75.
- [21] F.N. Iandola, S. Han, M. W. Moskewicz, K. Ashraf, W. J. Dally, and K. Keutzer, "Squeezenet: Alexnet-Level Accuracy With 50x Fewer Parameters And <0.5mb Model Size," *Computer Vision and Pattern Recognition (cs.CV); Artificial Intelligence (cs.AI)*, pp. 1-12, Nov. 2016. DOI: arXiv:1602.07360.
- [22] A. Krizhevsky, I. Sutskever, and G.E. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks," *Advances in Neural Information Processing Systems 25 (NIPS 2012)*.
- [23] A. Gholami, K. Kwon, B. Wu, Z. Tai, X. Yue, P. Jin, S. Zhao, and K. Keutzer, "SqueezeNext: Hardware-Aware Neural Network Design," in *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops*, 2018, pp. 1638-1647. DOI: arXiv:1803.10