UNIVERSITY OF SOUTH FLORIDA

Defense of a Doctoral Dissertation

Deep Learning Predictive Modeling with Data Challenges (Small, Big, or Imbalanced)

by

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For the Ph.D. degree in Computer Science and Engineering

In the real world, data used to build machine learning models always has different sizes and characteristics. These size and characteristic features, including small datasets, big datasets, imbalanced datasets, often lead to different challenges when training machine learning models. Models trained on a small number of observations tend to overfit the training data and produce inaccurate results. When it comes to big data, efficiently learning from "huge" size data in a short time becomes important. With an imbalanced dataset, learning is usually biased towards the majority class in the data and appropriate measurements are needed to check model performance. In medical imaging, we proposed a novel image feature extraction method for predicting survival time from brain tumor magnetic resonance images using pre-trained deep neural networks. We also introduced a novel method for over-sampling the minority class examples at the image level, rather than the feature vector level, to provide a solution to the problem of imbalanced medical imaging data. For social network analysis and future forecasting, we introduced a decomposition approach to address the long term fine time granularity simulation problem. The goal is to predict different user activities at hour granularity over a long period of time. In addition, when considering simulating user activities across multiple platforms, we introduced a sequence model approach which provides efficient long term cross platform simulation.

Examining Committee

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2:00 PM
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Publications

1) Liu, R., Mubang, F., Hall, L.O., Horawalavithana, S., Iamnitchi, A. and Skvoretz, J., 2019, October. Predicting Longitudinal User Activity at Fine Time Granularity in Online Collaborative Platforms. In 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC) (pp. 2535-2542). IEEE.
2) Horawalavithana, S., Bhattacharjee, A., Liu, R., Choudhury, N., O. Hall, L. and Iamnitchi, A., 2019, October. Mentions of Security Vulnerabilities on Reddit, Twitter and GitHub. In IEEE/WIC/ACM International Conference on Web Intelligence (pp. 200-207).
3) Ahmed, K.B., Hall, L.O., Liu, R., Gatenby, R.A. and Goldgof, D.B., 2019, October. Neuroimaging based survival time prediction of GBM patients using CNNs from small data. In 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC) (pp. 1331-1335). IEEE.
4) Liu, R., Hall, L.O., Bowyer, K.W., Goldgof, D.B., Gatenby, R. and Ahmed, K.B., 2017, October. Synthetic minority image over-sampling technique: How to improve AUC for glioblastoma patient survival prediction. In 2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC) (pp. 1357-1362). IEEE.
5) Ahmed, K.B., Hall, L.O., Goldgof, D.B., Liu, R. and Gatenby, R.A., 2017, March. Fine-tuning convolutional deep features for MRI based brain tumor classification. In Medical Imaging 2017: Computer-Aided Diagnosis (Vol. 10134, p. 101342E). International Society for Optics and Photonics.
6) Liu, R., Hall, L.O., Goldgof, D.B., Zhou, M., Gatenby, R.A. and Ahmed, K.B., 2016, July. Exploring deep features from brain tumor magnetic resonance images via transfer learning. In 2016 International Joint Conference on Neural Networks (IJCNN) (pp. 235-242). IEEE.

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