**ELEG 6913-P17: Deep Learning**

**Spring 2017**

**Department of Electrical and Computer Engineering**

**Prairie View A&M University**

**Project 1**

1. Deep learning involves many topics such as convolutional neural networks (CNN), recurrent neural networks (RNN), and so forth. Each topic concentrates on special concepts and methods for solving particular problems. Comprehending these topics would be benefit to not only figure out relations of concepts and methods of deep learning, but also to select topics for future researches. This project chooses six topics, and each topic involves some important papers in the development of deep learning.
2. Every student involved in this course has to select at least two papers to review, make presentations to explain key ideas contained in his/her chosen papers in detailed when we accomplish related topics, and submit a summary after the presentations.

**Bonus Section:**

*If you can implement some algorithms with C++ according to your review, you will obtain* *extra 20%* *scores. Requirements:*

1. *Run your codes on a large data set*
2. *Compare your results with some baseline models*

**Paper List:**

* **Deep Feed-Forward Networks**
  1. Activation Function for Hidden Unit
     + Maas, A. L., Hannun, A. Y., and Ng, A. Y. (2013). Rectifier nonlinearities improve neural network acoustic models. In ICML Workshop on Deep Learning for Audio, Speech, and Language Processing. (Johnson, De'Ahna R. )
     + He, K., Zhang, X., Ren, S., and Sun, J. (2015). Delving deep into rectifiers: Surpassing human-level performance on ImageNet classification. arXiv preprint arXiv:1502.01852 (Johnson, De'Ahna R. )
  2. Network Structure
     + Goodfellow, I. J., Bulatov, Y., Ibarz, J., Arnoud, S., and Shet, V. (2014d). Multi-digit number recognition from Street View imagery using deep convolutional neural networks. In International Conference on Learning Representations. (Johnson, Travon C. )
* **Regularization for Deep Learning**
  1. Dataset Augmentation
     + Jaitly, N. and Hinton, G. E. (2013). Vocal tract length perturbation (VTLP) improves speech recognition. In ICML’2013. (Johnson, Travon C. )
  2. Dropout
     + Srivastava, N., Hinton, G., Krizhevsky, A., Sutskever, I., and Salakhutdinov, R. (2014). Dropout: A simple way to prevent neural networks from overfitting. Journal of Machine Learning Research, 15, 1929–1958. ([Bamgbose, Samuel O.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=MzkyNTAy))
     + Warde-Farley, D., Goodfellow, I. J., Courville, A., and Bengio, Y. (2014). An empirical analysis of dropout in piecewise linear networks. In ICL (1). ([Bamgbose, Samuel O.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=MzkyNTAy))
     + Goodfellow, I. J., Warde-Farley, D., Mirza, M., Courville, A., and Bengio, Y. (2013b). Maxout networks. In ICM ( 1b), pages 1319–1327. ([Sobayo, Remilekun C.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDQ1NDU0))
     + Wager, S., Wang, S., and Liang, P. (2013). Dropout training as adaptive regularization. In Advances in Neural Information Processing Systems 26, pages 351–359. ([Sobayo, Remilekun C.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDQ1NDU0))
* **Optimization for Training Deep Models**
  1. Challenges in Neural Network Optimization
     + Saxe, A. M., McClelland, J. L., and Ganguli, S. (2013). Exact solutions to the nonlinear dynamics of learning in deep linear neural networks. In ICLR ([Omotere, Oluwaseyi O.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=MzgyNDYx))
     + Goodfellow, I. J., Vinyals, O., and Saxe, A. M. (2015). Qualitatively characterizing neural network optimization problems. In International Conference on Learning Representations. ([Omotere, Oluwaseyi O.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=MzgyNDYx))
  2. Parameter Initialization Strategies
     + Sussillo, D. (2014). Random walks: Training very deep nonlinear feed-forward networks with smart initialization. CoRR, abs/1412.6558. ([Jafari, Hossein](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=Mzg4NTMx))
     + Mishkin, D. and Matas, J. (2015). All you need is a good init. arXiv preprint arXiv:1511.06422 . ([Jafari, Hossein](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=Mzg4NTMx))
  3. Adaptive Learning Rates
     + Kingma, D. and Ba, J. (2014). Adam: A method for stochastic optimization. arXiv preprint arXiv:1412.6980 . ([Oluwadeyi, Olasunkanmi E.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDg4Nzk2))
  4. Optimization Strategies and Meta-Algorithms
     + Guillaume Desjardins, Karen Simonyan, R. P. K. K. (2015). Natural neural networks. Technical report, arXiv:1507.00210. ([Adesina, Damilola S.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDU1Nzcz))
     + Romero, A., Ballas, N., Ebrahimi Kahou, S., Chassang, A., Gatta, C., and Bengio, Y. (2015). Fitnets: Hints for thin deep nets. In ICLR’2015, arXiv:1412.6550 . ([Adesina, Damilola S.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDU1Nzcz))
     + Srivastava, R. K., Greff, K., and Schmidhuber, J. (2015). Highway networks. arXiv:1505.00387 . ([Oluwadeyi, Olasunkanmi E.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDg4Nzk2))
* **Convolutional Networks**
  1. Optimization Strategies
     + Lee, C.-Y., Xie, S., Gallagher, P., Zhang, Z., and Tu, Z. (2014). Deeply-supervised nets. arXiv preprint arXiv:1409.5185 . (Adejuwon, Oluseyi D)
  2. Pooling
     + Boureau, Y., Le Roux, N., Bach, F., Ponce, J., and LeCun, Y. (2011). Ask the locals: multi-way local pooling for image recognition. In Proc. International Conference on Computer Vision (ICCV’11). IEEE. (Mahmood, Safat )
     + Jia, Y., Huang, C., and Darrell, T. (2012). Beyond spatial pyramids: Receptive field learning for pooled image features. In Computer Vision and Pattern Recognition (CVPR), 2012 IEEE Conference on, pages 3370–3377. IEEE. (Mahmood, Safat )
  3. Network Depth
     + Simonyan, K. and Zisserman, A. (2015). Very deep convolutional networks for large-scale image recognition. In ICLR. (Adejuwon, Oluseyi D)
  4. Structured Outputs
     + Pinheiro, P. H. O. and Collobert, R. (2015). From image-level to pixel-level labeling with convolutional networks. In Conference on Computer Vision and Pattern Recognition (CVPR). ([Murillo, Ludwig](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDYwOTE5))
     + Jain, V., Murray, J. F., Roth, F., Turaga, S., Zhigulin, V., Briggman, K. L., Helmstaedter, M. N., Denk, W., and Seung, H. S. (2007). Supervised learning of image restoration with convolutional networks. In Computer Vision, 2007. ICCV 2007. IEEE 11th International Conference on, pages 1–8. IEEE. ([Murillo, Ludwig](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDYwOTE5))
     + Thompson, J., Jain, A., LeCun, Y., and Bregler, C. (2014). Joint training of a convolutional network and a graphical model for human pose estimation. In NIPS’2014 . (Kotteti, Chandra Mouli M)
  5. Random or Unsupervised Features
     + Saxe, A. M., Koh, P. W., Chen, Z., Bhand, M., Suresh, B., and Ng, A. (2011). On random weights and unsupervised feature learning. In Proc. ICML’2011. ACM. (Kotteti, Chandra Mouli M)
  6. Application
     + Long, Jonathan, Evan Shelhamer, and Trevor Darrell. "Fully convolutional networks for semantic segmentation." Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition. 2015. (Yan, Yuzhong )
     + LeCun, Y., Kavukcuoglu, K., and Farabet, C. (2010). Convolutional networks and applications in vision. In Circuits and Systems (ISCAS), Proceedings of 2010 IEEE International Symposium on, pages 253–256. IEEE. (Yan, Yuzhong)
* **Sequence Modeling: Recurrent and Recursive Nets**
  1. Teacher Forcing
     + Bengio, S., Vinyals, O., Jaitly, N., and Shazeer, N. (2015b). Scheduled sampling for sequence prediction with recurrent neural networks. Technical report, arXiv:1506.03099. ([Adekanmbi, Abayomi P.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDY4Mjc2))
  2. Application
     + Graves, A. and Schmidhuber, J. (2009). Offline handwriting recognition with multidimensional recurrent neural networks. In D. Koller, D. Schuurmans, Y. Bengio, and L. Bottou, editors, NIPS’2008 , pages 545–552 ([Adekanmbi, Abayomi P.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDY4Mjc2))
     + Graves, A., Mohamed, A., and Hinton, G. (2013). Speech recognition with deep recurrent neural networks. In ICASSP’2013, pages 6645–6649. ([Nagarajan, Ramya](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDYwMTY5))
     + Graves, A., Wayne, G., and Danihelka, I. (2014). Neural Turing machines. arXiv:1410.5401. ([Nagarajan, Ramya](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDYwMTY5))
  3. Encoder-Decoder Sequence-to-Sequence Architectures
     + Sutskever, I., Vinyals, O., and Le, Q. V. (2014). Sequence to sequence learning with neural networks. In NIPS’2014, arXiv:1409.3215 . (Chowdhury, Shanta)
     + Cho, K., Van Merriënboer, B., Gülçehre, Ç., Bahdanau, D., Bougares, F., Schwenk, H., and Bengio, Y. (2014a). Learning phrase representations using RNN encoder–decoder for statistical machine translation. In Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing (EMNLP), pages 1724–1734. Association for Computational Linguistics. (Chowdhury, Shanta)
  4. Deep Recurrent Networks
     + Pascanu, R., Mikolov, T., and Bengio, Y. (2013a). On the difficulty of training recurrent neural networks. In ICML’2013 (Bassey, Joshua N. \*)
  5. Recursive Neural Networks
     + Socher, R., Manning, C., and Ng, A. Y. (2011b). Parsing natural scenes and natural language with recursive neural networks. In Proceedings of the Twenty-Eighth International Conference on Machine Learning (ICML’2011). (Bassey, Joshua N. \*)
* **Autoencoders**
  1. Noise and Dataset Augmentation ([Olokodana, Ibrahim L.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDYyMTUx))
     + Poole, B., Sohl-Dickstein, J., and Ganguli, S. (2014). Analyzing noise in autoencoders and deep networks. CoRR, abs/1406.1831.
  2. Denoising Autoencoders
     + Alain, G. and Bengio, Y. (2013). What regularized auto-encoders learn from the data generating distribution. In ICLR’2013, arXiv:1211.4246 ([Olokodana, Ibrahim L.](https://pv-pssbw-102.pvamu.edu:9020/PROD/bwlkosad.P_FacSelectAtypView?xyz=NDYyMTUx))

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