COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

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for the degree of Doctor of Philosophy (Ph.D.)

## "DEEP MAXOUT NETWORKS FOR CLASSIFICATION PROBLEMS ACROSS MULTIPLE DOMAINS"

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ABSTRACT OF DISSERTATION
Deep Maxout Networks for Classification Problems Across Multiple Domains

Machine learning techniques such as deep neural networks have become an indispensable tool for a wide range of applications such as image classification, speech recognition, and sentiment analysis in text. An activation function is a mathematical equation that determines the output of each neuron in the neural network. In deep learning architectures the choice of activation functions is very important to the network's performance. Activation functions determine the output of the model, its computational efficiency, and its ability to train and converge after multiple iterations of training epochs. The selection of an activation function is critical to building and training an effective and efficient neural network. In real-world applications of deep neural networks, the activation function is a hyperparameter. We have observed a lack of consensus on how to select a good activation function for a deep neural network, and that a specific function may not be suitable for all domain-specific applications.
This dissertation investigates the effectiveness of multiple maxout activation function variants on multiple application domains using convolutional neural networks. A network with maxout activation has a higher number of trainable parameters compared to networks with traditional activation functions. However, it is not clear if the activation function itself or the increase in the number of trainable parameters is responsible for yielding

the best performance for different entity recognition tasks. This dissertation investigates if an increase in the number of convolutional filters on traditional activation functions performs similar-to or better-than maxout networks. Our experiments on seven different application domains compare the Rectified Linear Unit, Leaky Rectified Linear Unit, Scaled Exponential Linear Unit, and Hyperbolic Tangent activations to four maxout function variants. There are studies that claim maxout networks train faster than networks with traditional activation functions, e.g. Rectified Linear Unit. We determine whether maxout methods converge faster, and if there is a significant accuracy performance difference between these methods and the standard activation functions, such as the Rectified Linear Unit. Additionally, we present a review of common 2D facial recognition datasets, and provide recommendations for performance and statistic measures that are best suited for facial recognition.

BIOGRAPHICAL SKETCH
Born in Mexico City, Mexico
B.S., Instituto Tecnologico de Monterrey (ITESM), Mexico, 1997
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CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION

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**Selected Published Papers:**

Gabriel Castaneda, Paul Morris, and Taghi M Khoshgoftaar. Maxout Networks for Visual Recognition. International Journal of Multimedia Data Engineering and Management (IJMDEM), 21 pages, 2019 (Accepted).

Gabriel Castaneda, Paul Morris, and Taghi M Khoshgoftaar. Evaluation of maxout activations in deep learning across several big data domains. Journal of Big Data, 6(1):72, 35 pages, 2019.

Gabriel Castaneda, Paul Morris, and Taghi M Khoshgoftaar. Investigation of Maxout Activations on Convolutional Neural Networks for Big Data Text Sentiment Analysis. In 2019 32nd International Florida Artificial Intelligence Research Society Conference (FLAIRS-32), pages 250-255. AAAI. 2019.

Gabriel Castaneda and Taghi M Khoshgoftaar. A Review of Performance Evaluation on 2D Face Databases. In 2017 IEEE Third International Conference on Big Data Computing Service and Applications (BigDataService), pages 218-223. IEEE. 2017.

Gabriel Castaneda and Taghi M Khoshgoftaar. A survey of 2D face databases. In 2015 IEEE International Conference on Information Reuse and Integration (IRI), pages 219-224. IEEE. 2015.