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The Department of Automatic Control & Systems Engineering  
is pleased to announce the following seminar:

**“Recent Advances in Deep Learning : Feature Selection, Adversarial Attacks,  
Applications in Wireless Communications and Educational Efforts at Purdue  
Engineering”**

**Dr Aly El Gamal**

*Assistant Professor, Electrical and Computer Engineering Department  
Purdue University, Indiana  
USA*

**Tuesday, 23 July 2019 at 13:00**  
LT7, The Diamond

**Abstract**

Deep learning is a powerful tool that carries the promise of revolutionizing current computational frameworks. In this talk, I will first present recent work on two problems that lie at the core of making deep learning applicable in a ubiquitous fashion: 1- Selecting a subset of important features that leads to similar or higher learning performance while reducing the training time, as compared to using all available features. Two common categories of feature selection methods are filter methods that rely on intrinsic properties of the dataset, and wrapper methods that rely on evaluating the performance of a machine learning model that is retrained using every candidate combination of features. In general, filter methods are computationally efficient while wrapper methods deliver better learning performance. We propose an efficient deep-learning based wrapper method that exploits the transferability property of deep neural network architectures to avoid excessive retraining, as well as autoencoders to distill important dataset intrinsic properties, 2- Adversarial deep learning attacks that introduce small perturbations to the input data in sensitive directions, which negatively impacts the learning performance. Here, we propose novel strategies to preprocess the input data for defending adversarial attacks. Our strategies rely on properties of denoising autoencoders that are demonstrated to be powerful tools for extracting robust representations. In the second part of the talk, I will present our findings on applying deep learning in wireless communications and networking and discuss why we believe that it's a perfectly fit tool for various tasks enabling autonomous communication systems and resource management. This discussion will particularly highlight Purdue's successful journey in the DARPA Spectrum Collaboration Challenge (SC2). Finally, I will present our initiative at Purdue Engineering for machine learning graduate education, and how in general, Purdue is currently providing an ideal environment for graduate studies in engineering.

**Biography**

Aly El Gamal is an Assistant Professor at the Electrical and Computer Engineering Department of Purdue University. He received his Ph.D. degree in Electrical and Computer Engineering and M.S. degree in Mathematics from the University of Illinois at Urbana-Champaign, in 2014 and 2013, respectively. Prior to that, he received the M.S. degree in Electrical Engineering from Nile University and the B.S. degree in Computer Engineering from Cairo University, in 2009 and 2007, respectively. His research interests include information theory and machine learning.

Dr. El Gamal has received several awards, including the Purdue Seed for Success Award, the Purdue CNSIP Area Seminal Paper Award, the DARPA Spectrum Collaboration Challenge (SC2) Contract Award and Preliminary Events 1 and 2 Team Awards, and the Huawei Innovation Research Program (HIRP) OPEN Award. He is currently leading the Purdue and Texas A&M Team (BAM! Wireless) in DARPA SC2, co-leading the Purdue Engineering initiative for creating a machine learning group and developing graduate courses, and a reviewer for the American Mathematical Society (AMS) Mathematical Reviews.