School of Computer Science and Engineering
Presentation

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Tuesday, February 4, 2020
Time: 1:30pm – 2:30pm
JB-391

Learning from spatio-temporal patterns

Abstract: Learning and recognizing spatio-temporal patterns is an important problem for all biological systems and bioinformatics. Gestures, movements, activities, all encompass both spatial and temporal information that is critical for implicit communication and learning. In this talk I will focus on two methods for learning spatio-temporal patterns: 1) Spike timing neural networks, a biologically inspired machine learning technique that has attracted great attention in both academia and industry due to its great potential in many domains, such as bioinformatics, speech, vision, and language understanding, 2) Deep learning methods which obtain indisputable success in vision, language processing, speech, medicine, etc. In the first part of the talk, I will demonstrate a novel, unsupervised approach for learning, recognizing and early classifying spatio-temporal patterns using spik-ing neural networks. The proposed spiking approach has five variations which have been validated on images of handwritten digits and human hand gestures and motions [1, 2, 3, 4, 5, 6, 7, 8]. In the second part of the talk, I will cover novel techniques to effectively deal with spatio-temporal patterns with deep neural networks that are optimizable via stochastic gradient descent. Convolutional neural networks are powerful models that can leverage both temporal and spatial correlations. In order to learn long range dependencies, a dilated version of convolu-tional neural networks are used for early recognition of driver's intents from videos [9, 10]. In addition to early classification, it is important to model the stochasticity of the video prediction problems via generative modeling. I will introduce a novel deep learning model by combining variational autoencoders with generative adversarial networks to obtain a high quality video model that is capable of producing sharp, diverse and high quality out-put [11]. Finally, I will introduce a novel technique for a non-autoregressive text summarization technique via generative adversarial networks that are trained via the policy gradient method [12].

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