EECE 571 – Deep Learning in Digital Media

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COURSE DESCRIPTION:

This is a special topics course with emphasis on theoretical and practical concepts of deep learning for digital video applications ranging from entertainment to broadcasting, autonomous driving, smart cities and digital health. Topics include overview of neural networks, deep convolutional neural networks for image and video applications, Recurrent Neural networks for video processing, cost functions and regularization. Concepts of Digital image and video processing, capturing, compression and display technologies, Human perception, measures of visual quality and emerging visual trends of high dynamic range and light field will also be covered.

OUTLINE:

1. Introduction
2. Overview of Digital Image & Video Processing
3. Capturing, Compression & Display technologies
4. Human Visual System & Human Perception and
5. Measures of Visual Quality
4. High Dynamic Range and Light Field Technologies
5. Brief overview of Machine Learning & Neural Networks
6. Deep Learning
7. Deep Convolutional Neural Networks (CNN) for Image processing
8. Cost Function, CNN parameters and hyper parameters tuning
9. Underfitting, Overfitting and regularization for video processing
10. Recurrent Neural Network, Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU) for Video processing
11. Generative adversarial network for the video content
12. Autoencoder for image and video compression
13. Transfer learning for digital video

PROJECTS:

Students are organized in teams and work on one of the following projects:
Deep Learning in Digital Video processing and broadcasting (denoising, compression)
Deep Learning in Autonomous Driving
Deep Learning in Video Super Resolution (Upscaling)
Deep Learning in Smart Cities (Vehicle to Vehicle video communication, parking, etc.)
Deep Learning in Digital Health (Human Monitoring, Behavior)

EXPECTATIONS:

• Oral Presentation on the project topic by end of 3rd lecture
• A technical Report on the topic is due the day before. This should include introduction, background information, proposed approach, and bibliography.
• Final Project completion date: Last day of the course
• A final technical report is expected in the form of a paper. Software code and executable should also be submitted. Each team should demonstrate its work.
• Oral exam and questioning period will be allocated for each team. Questions will cover the course material and project work.

GRADING:

• Technical Report/Proposal 10%
• Presentation 1 (Oral Exam) 10%
• Final Technical Report 30%
• Presentation & Demo 15%
• Oral Exam 25%
• Teamwork 10%