EE544: Computer Vision (Incorporating Deep Learning)

Summary Syllabus[1] (Level 9[2])

Section	Indicative Content
Introduction	• Introduction to Python Computer Vision Development Environment • Computer vision Pipeline • Traditional vs deep learning approaches to computer vision • Learning Outcomes • Module Protocol • Assessment Requirement • Support Material & Website • Software Tools • Case Studies
Interest Point Detection & Feature Extraction	• SIFT - Scale Invariant Feature Transform • Histogram of Oriented Gradients (HOG) • Deformable Part Models (DPM)
Machine Learning for Computer Vision	• Classification • Feature Normalisation • Evaluation of Classifier Performance • Non-Parametric Classifiers / Decision Trees (DT) • Support Vector Machine (SVM) • SVM Multi-class Classification
Deep Learning for Computer Vision (ANN & CNN)	• Artificial Neural Networks • Logistic (Linear) Classifier • Gradient Descent / Stochastic Gradient Descent (SGD) • Backward Propagation • Regularisation Methods • Supervised Deep Learning • Convolution Neural Networks • Transfer Learning • Architectures • Unsupervised Learning
Deep Learning for Computer Vision (Classification, Visualisation & Localisation)	• CNN classification • Data Augmentation • Visualising CNN filters • Localise Objects with Regression • Object Detection as Classification • Region-Based CNN (R-CNN) • Single Shot Detectors (SSD)
Deep Learning for Computer Vision (Segmentation, Detection & Advanced)	• Semantic Segmentation • Fully Convolutional Networks • Instance Segmentation • Style Transfer Network • Deep Dream • Generative Adversarial Networks
Motion	• Optical Flow: 2D • Optical Flow Constraints • Local / Global Approaches • Feature Matching • Motion Correspondence • Kanade Lucas Tomasi (KLT) Tracking • DL

See **EE425/EE453: Image Processing & Analysis** for an introductory Level 8 module in this area.

The module will develop solutions within a **Python** based development environment. Specifically we will use the open source and widely adopted **scikit-image, opencv** and **scikit-learn** libraries in designing advanced computer vision and machine learning solutions. Building on this we will develop our deep learning solutions within the very popular **Keras** (a high-level Python based neural networks API / **Tensorflow** (an open-source software library for Machine Intelligence) environment.

[1] Indicative content – details may vary from year to year.

[2] NFQ Level 9 – Master's Degree