SU DEPARTMENT OF COMPUTER SCIENCE SYLLABUS
COSC 490 SPECIAL TOPICS: Convolutional Neural Networks and Applications

Description: This course covers the fundamentals of neural networks, the design and optimization of Convolutional Neural Network (CNN) architectures, feature representation, and popular CNN models. This course emphasizes on hands-on implementation with frameworks like TensorFlow and PyTorch. Students will explore diverse real-world applications, including image classification, object detection, medical data analysis, and natural language processing. At the end of this course, students will master the skills needed to design, train, and deploy CNN models effectively for real-world applications. Three hours per week.

Prerequisites: Grade of "C" or better in COSC 220 and COSC 311
Required Textbook: No required textbook. Lecture notes are available from the instructor.
References:

- Deep Learning. Ian Goodfellow et al., *MIT Press*.
- Deep Learning with Python (2nd Edition). François Chollet, *Manning Publications*.
- Python Machine Learning (3rd Edition). Sebastian Raschka & Vahid Mirjalili. *Packt Publishing*.

	Weeks
Python Environment & Development Framework	***1***
Anaconda, TensorFlow, PyTorch	
Fundamentals of Neural Networks	***2***
Perceptron, feedforward networks, backpropagation, stochastic gradient descent, regularization and hyperparameter tuning, evaluation metrics	
Design and Optimization of CNN Architectures	***3***
Convolution operations, pooling techniques, activation functions (e.g., ReLU), number of layers & layer types, depth and width of the network, parameter optimization (filter size, stride, and padding), trade-offs between accuracy, complexity, and cost	
Feature Representation, Popular CNN Models	***3***
Feature extraction and maps, widely-used CNN models (AlexNet, VGGNet, GoogLeNet, ResNet, etc.)	
Applications of CNNs	***3***
Image classification, object detection, medical data analysis, natural language processing	
Optional Topic: Transfer learning	***1***
Fine-tuning strategies for transfer learning, domain adaptation techniques	
Exams	***1***

EVALUATION

Homework, labs, class participation: 30%
Projects and presentations: 40%
Exams and quizzes: 30%

NOTE: ONCE A STUDENT HAS RECEIVED CREDIT, INCLUDING TRANSFER CREDIT, FOR A COURSE, CREDIT MAY NOT BE RECEIVED FOR ANY COURSE WITH MATERIAL THAT IS EQUIVALENT TO IT OR IS A PREREQUISITE FOR IT.

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