Past Innovative Computing Courses

Fundamentals of Blockchain and Smart Contracts (Dr. Reza Parizi)

This course is designed to equip students with core foundational knowledge and innovative concepts, techniques, and industrial-strength frameworks for perceiving and developing blockchain apps and smart contracts in an engineering-supported manner. The goals are for students to:

- Understand how blockchain technology works under the hood, including Enterprise (Hyperledger Fabric) and Public (Ethereum) platforms.
- Learn smart contract programming using Solidity language.
- Deploy smart contracts to the blockchain network and interact using Web3js.
- Build full-stack decentralized applications (dApps) using Truffle framework on top of Ethereum blockchain.
- Apply best practices for smart contract security to avoid vulnerabilities.
- Perform research projects to understand the state-of-the-art achievements as well as future trends.

Introduction to the Autonomous Vehicles (Dr. Mohammed Aledhari)

This is an introduction to the autonomous vehicles (AV) enabling technologies course that will provide concrete ideas to students by implementing the most critical AV algorithms. With market researchers predicting a $42-billion market and more than 20 million self-driving cars on the road by 2025, the next big job boom is right around the corner. This course will be following a "learn by doing" style to create an amazing and enjoyable course. This particular course is one of the most transformative technologies to emerge. Students will learn some computer vision techniques to find lane markings on the road. Also, they will be building and training neural networks, starting with the foundations, ending in backpropagation and multilayer perceptron networks. Through this course, students will be able to explain the theory behind Convolutional Neural Networks and how they dramatically improve the performance of image classifications. Upon completion this course successfully, students will be able to build their own self-driving software stack and be ready to apply for jobs in the autonomous vehicle industry

Fog Computing (Dr. Selena He)

13 students explored different System-on-Chip platforms to design and implement Internet-of-Things (IoT) applications and submitted their projects to ACMSE and NCUR.

Introduction to FinTech (Dr. Meng Han)

12 students included undergraduates, Master and Ph.D. students explored the fundamental knowledge of FinTech, and particularly, put a strong emphasis on the blockchain and artificial intelligence, and to prepare for the next wave of FinTech innovations.

After successful completion of this course, the students are able to know:

- What is the core and novel sources of FinTech data, how are they managed
- What are the main trends in the FinTech
- What are the critical technology strategies in FinTech
- Where are the limits, risks, and social implications of FinTech
- How to implement a blockchain, and how to write a "smart contract" in Python/Ethereum, etc.

Data-driven Security (Dr. Meng Han)

The course covers topics that range from: concepts of data security & privacy, performing exploratory security privacy data analysis, map to regression, visualizing security data, to the learning from security breaches. All these concepts and skill help student to achieve a deep understanding and manipulating ability to the area of data security & privacy.

After successful completion of this course, the students are able to:

- Have a fundamental understanding of the concepts of data security & privacy
- Have an understanding of how to acquire, prepare, and visualize security data
- Have a knowledge on mapping security data and learn statistical
- Have a skill of developing effective, informative security dashboards
- Have an ability of designing analytical models to detect malicious behavior in real world

Advanced Software Engineering in VR/AR Application Design and Development (Dr. Meng Han, Dr. Rongkai Guo)

This is a multi-disciplinary course. Students from different majors has enrolled in this course including CGDD, SWE and CS. The course provided the students with fundamental and concepts of VR/AR. Students learned and applied software engineering agile methods, tools, and process models to develop VR/AR applications. The course projects application domains include computer games, simulations, educational tools, etc. Featured projects and publication are summarized as below.

1. Enable an Innovative Prolonged Exposure Therapy of Attention Deficits on Autism Spectrum through Adaptive Virtual Environments (published in VSGame 2018)
   o A prototype of adaptive virtual environments therapy system (AVET) was developed which will enable innovative Virtual Reality (VR)-based therapy approach for children with attention deficit on the autism spectrum. Many systems have successfully used VR in Autism Spectrum Disorders (ASD) therapies. Most of them use VR as an alternative way to conduct therapies by simulating traditional therapies or real-life experiences. However, current systems appear to miss some exclusive features of VR such as generating "impossible experiences" (e.g., a chair that deforms upon the user's gaze, a transparent human). This resource was not available when traditional therapy approaches were designed. With the recent development of VR, regrettably, it has still not yet been applied or studied. The AVET employs specifically designed VR "impossible experiences" to identify, influence the user's cognition, and delivers a customized Prolonged Exposure (PE)-style VR therapy for children with attention deficits on the autism spectrum.

2. A Virtual Realty Biking System to Increase the Motivation of Indoor Biking (to be submitted)
   o One of the major challenges for indoor exercises, such as stationary bike training, is maintaining engagement and motivation over time. Previous research has shown that games can increase the motivation of doing exercises. We are interested in providing a better indoor experience with gaming. Specifically, we enhanced the indoor stationary biking with immersive virtual environments. We developed a biking simulation where a real bike is connected to a virtual environment through sensors. We expect this system can increase the motivation and engagement of indoor biking.

3. Increase the Awareness of ASD through A Virtual Reality Game Written by A Student with Special Needs (to be submitted)
   o This paper presents a prototype of a Virtual Reality game that is designed to embody players in a college student with Autism Spectrum Disorders (ASD). We hope to increase colleges students' awareness of autism through playing a game, so that student can learn how to better help and communicate with their classmates who has autism. The game story and scripts are written by a journalism major college student, who has high-functioning autism.