Individual Capstone Assessment

Human pose estimation is the process of identifying positions of a person's joints in an image or video. It is a significant problem that has received great attention from the computer vision community these days. The technology will have huge implications in understanding human activities in images and videos. With the public released human pose datasets, the task is simplified to build a model based on body joints regression. Recent developments show that deep convolutional neural networks based models have achieved the state-of-the-art performance. Following the state-of-the-art approach, my senior design project is to implement a deep learning based human pose estimation application that predicts human pose from videos in real-time.

As a senior in UC, through Five years' training, I have a strong background in programming experience and theoretical mathematics/statistical foundation. In computer sciences field, I've successfully completed the core courses such as Computer Sciences 1(CS1021C), Data Structures(CS2028C), Python Programming(CS2011), Programming Language(CS4003), Design and Analysis of Algorithms(CS4092), Software Engineering(EECE3093C), Database Design and Development(CS4092), and Artificial Intelligence(CS4033) with excellent grades. In the data structure course, I have learnt the basic knowledge of data organization, management, and storage format that enables efficient access and modification and practice to be able to master useful data structures in different problems. The Computer Sciences 1, Python Programming, Programming language, Database Design and Development are mostly programming courses to

establish the foundation of programming. Computer Sciences 1 and Python Programming helps me learn C++ and python from scratches. Programming Language gave me the opportunity to interact with more languages like Java, Scheme, and Haskell. Database Design and Development built the primary designing knowledge of database, data warehouse, and foundation of being a business analyst. Software Engineering and Artificial Intelligence are applied courses which helps me learn different software designing patterns and AI applications. For now, I am in the class of Operating Systems(EECE4029) to touch the kernel-level programming; Machine Learning(CS5173) to keep learning difference models and play with it; Soft Computing based AI(AEEM 5197) to learn fuzzy logic and design fuzzy system and experience its impact in AI field. In the Statistics field, I have finished all the core courses with straight A grades. I have successfully accomplished a math capstone project of fraud detection based on Machine Learning to achieve high accuracy. I have adopted three different machine learning models: PCA, Logistic Regression, ANNs (Artificial Neural Networks) using labeled fraud dataset for fraud detection.

Within the 2-semester Cincinnati Children's co-op experience, I practiced python programming, Matlab and Excel and learned more new languages such as R for performing the data analysis and displaying the statistical result, SQL for the database, HTML, CSS, and javascript for the web designer. I also touched statistical analysis and bioinformatics technology,and presented my research results professionally with a clear and straightforward layout and appropriate charts to express and present professional and accurate. In the co-op experience at P&G, I applied my previous research abilities in a cheminformatics project. I have successfully identified the best platform for tool development based on cost, programming ease, flexibility and the potential to

share externally for the SAR project. I also developed a tool for computing the structural similarity between an analog and an SOI using several different structural fingerprints. Based on the similarity comparison to further compute the non-structural similarity scores for evaluating metabolism, reactivity and physical chemical properties. And got evidence that analog suitability may be consistent with non-structural similarity scores.

With the great interest of AI, I selected this project topic. The AI-related courses I have taken provide the academic support of this project. I have also learned many programming languages which helps me to build an application. This project includes two parts: 1. Deep learning model training; 2. Video processing application framework design. I plan to build a deep convolutional model using Pytorch and train it with the MPII human pose dataset. Python will be used to design the overall framework for the application user interface. OpenCV is applied to process the input and output videos.

The project needs to predict accurate human joint skeletons from a given video or camera stream. The application should have a friendly GUI to select a video or camera to process. Display the original video and estimated skeletons on the screen at the same time. Split the MPII dataset into training and test data to evaluate the model accuracy performance with the test dataset. Metric FPS(Frame per second) is to evaluate the processing speed of the model. We are able to evaluate the project by demonstrating the extraction of the human joint skeleton from the camera in real-time.