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Summary

- Master of Science in Computer Science (Spring 2017 from Uni. Of Texas, Arlington), along with 5 years of industry experience in software design and development
- Specialization in machine learning algorithms for robotics
- **MS thesis:** An approach to activity detection and classification aimed at smart-floor data using Hidden Markov Models (HMM)
- Explored GPGPU to boost up performance of these HMM
- Worked on PR2 robot using Robot Operating System (ROS) framework for Human Computer Interaction (HCI) applications.
- Experienced in agile software development processes, for front-end as well as back-end web development

Skills

- **Programming languages:** Java (OCJP 93%), Python, C++, C#, MATLAB, JavaScript
- **Machine learning libraries:** Scikit-learn, numpy, and matplotlib
- **Databases:** Oracle, MySQL
- **Other technologies:** GPGPU, Web services, HTML, jQuery, XML, Struts, Spring, Robot Operating System (ROS), Linux, Git, Eclipse, Visual Studio

Academic Projects

MS Thesis: Activity Detection and Classification on a Smart Floor (URL: PDF)

An approach to activity detection and classification aimed at smart-floor data is developed and evaluated.

A smart-floor has pressure-sensors mounted on it, from which data can be acquired, analyzed, and used for various purposes, such as Action and Activity Detection. For example, actions performed on the floor such as standing, walking, and turning can be identified. In addition, these actions can then be linked to certain activities such as *preparing coffee brewing machine, washing a mug at the basin*, *getting brewed coffee from the machine*, etc. For this purpose, the Logistic Regression and Hidden Markov Models (HMM) are used.

- The idea is to use Hierarchical HMM (HHMM) for learning for classification, but the forward probability calculation in HHMM takes $O(NT^3)$ where N is the number of hidden states and T is the length of observation sequence. Since cubic time is not feasible to compute with the increase of hidden states and observation sequence length, a flat HMM is developed by modifying Baum-Welch algorithm which takes $O(NT^2)$ to compute forward probability.
- As part of preprocessing, eliminated the noise in the unloaded sensors by performing floor calibration. Extracted 76 features from the pressure sensors data such as center of pressure, speed, and average pressure are used for the detection and classification. These features are then translated into frequency components using a multidimensional fast Fourier transform (FFT) algorithm. Finally, with the help of Logistic Regression, reduced 76 dimensional features to three dimensions.
- Manually labeled the data in MATLAB, and HMM models are used to capture longer-term relations in activities and to capture the points more precisely where transitions between activities occur. To build the HMM, presented the variations of the Baum Welch algorithm for partially and semi-supervised applications. The proposed HMM model is achieved 89% classification accuracy and the accuracy is increased to 95% with the semi-supervised learning approach.
- The computations are performed in logs and ran on four cores of CPU in parallel to reduce the training time. However, the class labelling is still manual, this can be automated to reduce the human efforts.

HTKS Game using Nao Robot for Children

Worked on Nao robot and implemented HTKS game to improve children executive functions using Python API. In HTKS game, children are instructed to touch either their head, knees, toes or shoulder by imitating the actions performed by the NAO Robot.

- Implemented actions and movements of NAO robot using *Choregraphe* tool and Python API
- Developed a user interface to interact with robot using *.NET* framework.
- Used a Kinect 2.0 camera to evaluate children's actions during the game.
- But not able to evaluate the few actions due to occlusion problems. When children touch their feet, not able determine the angles between joints using Kinect APIs available in Unity software. Guessing that a better machine learning training is required to solve this problem.

Unmanned Vehicle Systems

Built an autonomous ground vehicle (Rover), capable of accomplishing waypoint navigation, obstacle detection and avoidance, and path planning.

- Designed and assembled the rover, attached Pixhawk flight controller and Global Positioning System (GPS) receiver for waypoint navigation using a mission planner
- Implemented the Guidance, Navigation, and Control (GNC) algorithm for a course *Introduction to Unmanned Vehicle Systems*
- Manhattan Distance path planning algorithm for navigation with the obstacle avoidance
- Learned that tuning the parameter of KP and KI values of a closed loop PID controller is painful and not able to tune accurately. As a result, the rover left and right turns are not symmetrical.

Media Control Using Gestures Detection

- Implemented Gesture detection system (GDS) using Microsoft Kinect 2.0, and the GDS helps to issue commands to control media (E.g. Video) using gestures
- The GDS detects Commands like Play, Pause, Stop, and Volume Control by using the Skeleton Model of the Kinect

Employment

Research Assistant (Uni. of Texas-Arlington Research Institute, Jun 2016 – Dec 2016)

- Worked on PR2 robot state machine for pick and place tasks scenarios, as well as worked on face emulator for PR2 robot
- Created a human behavior detector for identifying behaviors such as, when user is lying on bed, sitting, and standing

Teaching Assistant (University of Texas-Arlington, Sep 2015 - May 2016)

- For Design and Analysis of Algorithms course and lab, including office hours

Analyst (Verizon Data Services India Pvt. Ltd, May 2012 – Dec 2014)

- Worked on prototype to generate business processes using model-driven architecture
- Worked on web applications for Verizon customer service portals
- Worked in architecture team and developed proof of concepts for teams using service-oriented architecture, Apache Velocity templates, Spring, and JavaScript

IT Engineer (Hewlett-Packard Global Soft Limited India, Oct 2010 – May 2012)

- Provided enhancements based on business requirements, maintained and supported HP internal applications which involves product life cycle management, using Java based frameworks, and XML
- Developed code to create new parts in *windchill* tool using Python.

Trainee Software Engineer (Intense Technologies, Nov 2009 - Sep 2010)

- Worked in web application development which involves developing code for query builder using Struts, HTML, Oracle, and JavaScript.
- Coded report generation and to export them in various formats such PDF and MS Excel.