Jose Peeterson

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Residential status: **Singapore Permanent Resident**

EDUCATION:

National University of Singapore (NUS) **Jan 2019 – May 2021**
Master of Engineering, Electrical Engineering (Part-time)

National University of Singapore (NUS) **Aug 2010 – May 2014**
Bachelor of Engineering, Electrical Engineering (Honors)

WORK EXPERIENCE:

Continental Automotive Singapore Pte. Ltd. **Jun 2020 – Dec 2020**
Machine Learning Intern, A.I., Big data team

- Performed robot simulation on Stage and Gazebo to test the algorithm implemented from the paper “Towards Optimally Decentralized Multi-Robot Collision Avoidance via Deep Reinforcement Learning” by senior data scientist.
- Created 3 worlds called straight-corridor, L-corridor and Plus-corridor with 20 scenes each, involving variation of static and dynamic obstacles for robot to avoid collision and reach the goal in closed environments.
- Used PYTHON and ROS libraries to write a new child class for the scenarios including robot, goal and obstacles in stage and gazebo to test RL policies of different training iterations. Managed code changes in the corporate GitHub repository and resolved code conflicts with the team through pull requests when merging with the master branch.
- Analyzed and troubleshooted test case failures such as robot not registering crash with obstacle, obstacles passing through walls, interference of obstacles from previous episode and robot timeout without reaching goal due to local minima traps caused by a left turning bias in the robot. Fixed errors in logging such as printing bugs in pickle file by code refactoring read and write statistics.
- Tested various policies with different number of iterations of training like 300, 400, 500, 600, 700 1000 and 2000.
- Documented and evaluated test accuracy based on number of goal-reached runs, collisions and timeouts for 100 episodes of 20 scenes for the 3 worlds using different policies. Policy 500 gave the highest test accuracy of 84%.
- Facilitated with calibration of 2D lidar on the jackal hardware robot in order to test trained policies from simulation.
- Configured the laser scan parameters (motor speed/callback time interval and sampling frequency) to maximize number of scans per rotation and built the lidar ROS package to interface real-time readings with code.
- Used histograms and polar plots to study laser scan noises such as outlier points, beam overlap and jittering noise in order to model them as gaussian noise and inject them during training. K-means clustering with automatic number of clusters detection was used to detect the true cluster’s standard deviation from clusters due to beam overlap.
- Created a troubleshooting guide of issues related to SSH, ROS file system, Virtual environments, Python, Stage and Gazebo, multiple concurrent simulations, Git, Jackal robot and 2D Lidar.

➢ Trained and tested an indoor-outdoor classifier using Logistic regression and SVM to detect robot's surroundings.
➢ Created hand-crafted features such as number of obstacles/lines, corners, obstacle density and out of range percentage from 2D laser scans and an obstacle detector ROS package.
➢ Dataset of 2200 laser scans from 6 map types (3 indoor and 3 outdoor) and 4 obstacle types for each map was generated from the stage simulator. In each map robot was placed at 9 points and rotated 10 times at each point.
➢ Disjoint train and test sets were used so that feature vectors from both sets had least correlation between them.
➢ Data was split along map types, obstacle types and robot position with different train-test ratios in order to check the model’s bias and variance and whether it overfits, underfits or fits well to the training data.
➢ Test accuracy of 95% for SVM and 98% for Logistic regression was achieved when split 50 – 50 for robot position.
➢ Test accuracy of 91% (98%) for SVM and 98% (98%) for Logistic regression was achieved when training with low (High) density obstacle type and testing with high (low) density obstacle types respectively.
➢ 97% test accuracy for SVM and 98% for Logistic regression was achieved when using different maps to train and test.
➢ The model had low variance and good generalization capability.

Continental Automotive Singapore Pte. Ltd. **Jun 2018 – May 2020**

Electronics Engineer – Business Unit: Transmission

- Designed and developed Electronic control units for automobile transmission applications like clutch actuators.
- Tested and qualified ECUs as per customer requirements and managed sample revisions until mass production.

ASM Technology, Singapore **Jun 2014 – Jun 2018**

Electronics Engineer – Motion group

- Designed, Developed, Maintained and sustained single phase Switch-Mode Power Supplies (SMPS).
- Continuously worked with reliability team to analyze the quality (Mean Time To Failure (MTTF), Failure modes and Effects Analysis (FMEA)) of SMPS returned from the field. Prepared FMEA documentation to improve future designs.

Seagate Technology International, Singapore **Jan 2013 – Jul 2013**

Product development Intern, System Integration

- Designed and Developed a Surrogate HDD Embedded Events Recorder (SHEER) PCB to allow customization of HDD for new laptop models early in their development cycle.

MAJOR PROJECTS IN NUS (Graduate level):

- **EE5731: Visual computing** **Aug 2020 – Dec 2020**
  - ***Panoramic Image stitching***
    - In MATLAB, 2D convolution using sobel, 5 Haar-like features and Gaussian kernels at different scales and sigmas was used to detect edges, lines, double corners and blur spurious noise.
    - Used RANSAC and performed homographic transformation between canvas and images, extracted Sift keypoints to match corresponding points and stitched them into a panaroma.
  - ***Depth Estimation from Stereo and Video***
    - Performed binary graph cut on a noisy image setup as pairwise Markov Random Fields.
    - Depth/Disparity levels from rectified stereo images was obtained by comparing pixels with similar intensities. Disparity initialization, bundle optimization and iterative optimization were followed to do Energy minimization of 7 images in a video sequence was used to create a depth map.

- **EE5907 Pattern Recognition** **Jan 2020 – May 2020**
  - ***Generative, Discriminative and Non-parametric classification***
    - In PYTHON, binarized and log-transformed features from E-mail messages were used to train and compare classification accuracy of different classifiers.
    - Test accuracy of Beta-Binomial naive Bayes classifier (Generative classifier) with beta prior parameters Beta(1,1) was 89.6%. Test accuracy of Gaussian naive Bayes classifier (Generative classifier) was 82.16%.
    - Discriminative classifiers like Logistic regression model using Newton’s Method with l2 regularization (**λ** = 10) resulted in the best test accuracy of 94.4%
    - Nonparametric classifier like K-Nearest Neighbors (K = 10 neighbors) test classification accuracy was 92.57%
  - ***Classification of handwritten digits from MNIST database***
    - Principal Component Analysis was performed through Mean centering of data points and creation of the covariance matrix from the training set. The eigenvectors of largest eigenvalues were used to identify features with largest variance to help with dimensionality reduction of the feature vector.
    - Eigen-digits with only 30 dimensions were formed by projecting each data point of 784 features into the subspace spanned by the top 30 eigenvectors of the covariance matrix.
    - Linear and Polynomial regression involving the 2nd and 3rd degrees were used to classify 10000 samples with test accuracy of 81.44% and 96.71%

- **EE5904: Neural Networks** **Jan 2019 – May 2019**
  - ***Image Classification***
    - A feedforward Multi-layer perceptron with regularization was designed in MATLAB to classify animals from man-

made objects through batch mode of learning. 900 images were used to train, and 100 images were used to test.

- A 3-layer (50 hidden neurons) MLP with regularization to reduce overfitting resulted 85% test accuracy.

o ***Support Vector Machines for Classification of Spam Email Messages***

- 57 attributes representing key features of an email message and a label indicating whether the email message was spam or not were used for training and testing.
- Hard margin (polynomial degree, p = 5) test accuracy was 88.3%. Soft Margin (P = 4, C = 2.1) test accuracy was 92.5%. SVM with soft margin parameter C = 1.1 and 2.1 generally outperformed other SVMs. Large C values led to smaller margin but also fewer misclassification and greater accuracy, so it has better generalization capability. Smaller C values led to larger margin but more misclassification and lower accuracy.

o ***Q-Learning for World Grid Navigation***

- A Q-learning ε-greedy exploitation algorithm was implemented in MATLAB to enable an agent to traverse a 10x10 grid from the start state to stop state following an optimal policy in order to maximize the total reward of the trip when finishing at the final stop state. Reward information was predefined for each action at a state.
- The results showed that for learning rate and exploration probability, $\alpha_k = \varepsilon_k = \frac{100}{100+k}$ optimal policy was found within 3000 iterations in each of the 10 runs. It also had the fastest average execution time of 0.30 seconds compared to the other rates like $\alpha_k = \varepsilon_k = \frac{1+\log(k)}{k}$ which had execution times of 0.74 seconds.

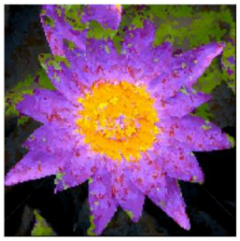
- **EE4212: Computer Vision** **Jan 2019 – May 2019**

o ***Non-Parametric sampling for texture synthesis***

- An algorithm called PatchMatch was implemented in MATLAB using the Image Processing Toolbox (IPT) to find similar patches between two similar images and speed-up (image) texture synthesis. Basically, reconstruction of one image from patches from another similar image.

Image A

Image B

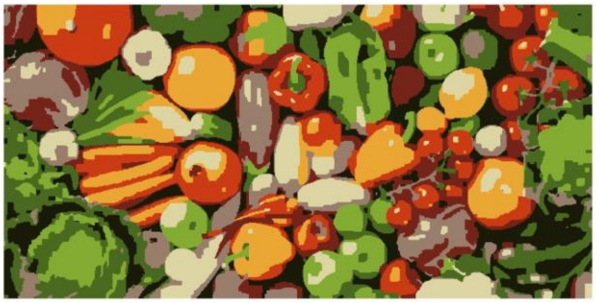


Reconstructed image A

o ***Color segmentation using multi-label graph cuts***

- In MATLAB, K-mean clustering function from Statistics and Machine Learning Toolbox was implemented to initialize the segmentation, and to obtain K-center colors or segments as defined by the user.
- A third party graph cut MEX function with wrapper for MATLAB was adopted from authors S. Bagon, R. Zabih, Y. Boykov and O. Veksler was used to do Graph Cut energy minimization operations on the 2D image.
- The output of this function provided for each pixel a label from one of the k cluster centers.

Original image



Segmentation results for k = 8 (centers/colors)

MAJOR PROJECTS IN NUS (Undergraduate level):

- **Final Year Project** **Aug 2013 – May 2014**
- Design and development of a 7.5KW three-phase Power Factor Corrected buck-type PWM rectifier for Microgrid.
- Performed simulations using Matlab and Simulink models to obtain the optimum design that meets specifications.
- Validation of simulation model by hardware testing of IGBT's, switching circuits and control algorithm using Industry standard Simulink-dSpace Real-Time-Interface I/O board.
- Completed successfully with a final grade of A-.

Software and Hardware Competencies

Software:

- ✓ Visual studio code, Pycharm, Github, ROS, Linux, Stage, Gazebo, rviz
- ✓ Confluence, Jira board, Microsoft Office, ICDL advanced EXCEL certificate, Microsoft Visio
- ✓ PYTHON, MATLAB, XML, YAML, C/C++, ARM Assembly language, Code Composer Studio, JAVA, HTML, PHP
- ✓ Labview, LTSpice, PSpice, Tina-TI, NI ELVIS, dSPACE, Simulink, Mathcad
- ✓ Zuken schematic/PCB, HyperLynx Mentor Graphics, PADS PowerLogic, PADS PowerPCB, ExpressSCH, PCB CAM Tool
- ✓ CANoe, CANalyzer, INCA, CANAPE. Knowledge of CAN, LIN, UDS protocols

Hardware:

- ✓ Jackal robot, rplidar lidar, sweep lidar
- ✓ Tektronix MSO54 mixed signal oscilloscope, current probe TCP303, voltage probe TPP1000, differential probe TDP0500, Keysight U1732C LCR meter, Keysight U1242 True RMS multimeter, Langer H & E Field probes,
- ✓ Keithley 2260B-30-36 power supply, Kikusui Plz1205w electronic load, Keysight 33600A waveform generator.
- ✓ Lecroy Wavesurfer 3054 Logic Analyzer, Keysight CXA EMC spectrum analyzer, OMRON Sysmac PLC,
- ✓ MHB-250M-2 Magtrol Motor brake, Espec PG-2J Thermal chamber, Keysight 34972A Datalogger, ,
- ✓ LA-7705 Lauterbach debugger, VN1610 and ES581.3 USB to CAN interface
- ✓ Infineon TC233 microcontroller, NXP FS6500 PSBC IC. BLDC1 motor driver

Business skills: Project Management, Leadership, Interpersonal Communication skills. Fluent in English and Tamil (both spoken and written), IMS/MKS, DOORS, PDCA, PAIL, PLC, CBS, TISAX, ASIL, FSM. ISO26262