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Al Arafat

Research Interest

Deep Learning | **Probabilistic Machine Learning** | **Computer Vision** | **Bayesian Nonparametric**

Education

2018 **International Summer School on Deep Learning**
University of Genoa, Itlay
Courses: CNN, GANs, Mathematics of Deep Learning, Domain Adaptation, Model Selection, Deep Kernel Machines, Optimization, Tensor Decomposition, Reinforcement Learning, etc.

2014–2016 **M.Sc in Computer Vision and Robotics from Erasmus Mundus Vision and Robotics(VIBOT) master program**
University of Burgundy, France. *University of Girona, Spain.* *Heriot-Watt University, Scotland, UK.*
Thesis: Computer Vision based Aircraft parts Inspection
[Research Group: Institute Clément Ader, École nationale supérieure des mines d'Albi-Carmaux, France]
Contributions included detecting and inspecting Airbus A320's tires, pitot tubes, and engine blades, from RGB images, using computer vision and machine learning techniques. I worked on C++ STL using OpenCV and Caffe library. The work was demonstrated using the **"AirCobot"** robot to inspect an Airbus A320 on turmac.

2008–2012 **B.Sc.Engg. in Computer Science and Engineering**
Rajshahi University of Engineering & Technology (RUET), Bangladesh.
Thesis: Intelligent Autonomous Vehicle Navigated by using Artificial Neural Network & DTMF signaling over GSM Network
Developed a robot navigation algorithm using Concurrent Self-Organizing Map classifier (3 classses, straight, left, or right). The demo robot could also be controlled by using mobile phone key-tone (DTMF) signals.

Professional & Research Experiences

12/16–Now **Research & Development Engineer, Computer Vision & Machine Learning**
Sony Depthsensing Solutions, Belgium
Prototyping and developing Deep Learning and Machine Learning algorithms to solve Computer Vision tasks, including but not limited to **object detection and localization**, **object tracking**, and **pose estimation**. I use Python and Tensorflow for the projects.

01/16–06/16 **Graduate Research Intern**
École nationale supérieure des mines d'Albi-Carmaux, Albi, France
Worked towards my M.Sc thesis under the scope of AirCobot project, in a collaboration with Airbus. The project was demonstrated performing field inspection of an Airbus A320 on May 2016.

06/16–12/16 & 06/13–09/14 **Lecturer, Department of Computer Science and Engineering**
Bangladesh University of Business & Technology, Dhaka, Bangladesh.
My responsibilities were to offer undergraduate courses and supervise projects. I offered **Object Oriented Programming**, **Artificial Intelligence**, **Machine Learning**, and **Pattern Recognition** courses.

09/12–06/13 **Lecturer, Department of Computer Science and Engineering**
Dhaka International University, Dhaka, Bangladesh.
My responsibilities were to offer undergraduate courses and supervise projects. I offered **Structured Programming**, and **Artificial Intelligence** courses. I supervised an undergraduate project on active-passive clustering.

Publications

2016 *Jovancevic I., Arafat A., Orteu J.-J., Thierry Sentenac:* **Airplane tire inspection by image processing technique**, In 5th Mediterranean Conference on Embedded Computing, MECO'2016, Bar, Montenegro, pp.176-179

2012 *Firoz Mahmud, Al Arafat, Syed Tauhid Zuhori :* **Intelligent Autonomous Vehicle Navigated by using Artificial Neural Network,** at International Conference on Electrical & Computer Engineering (ICECE), BUET, Dhaka, Bangladesh, pp.105-108

Selected Projects

Ongoing, 2018 **Driver pose estimation and skeleton tracking using Deep Learning** *Sony*
Althorithmic details are Confidential.

Ongoing, 2018 **Visualize the intuition behind your Deep CNN models** *Sony*
Developing a PyQt based Deep CNN visualizer. Supports visualizing Activation map, Deep Dream, Attention map, and etc.

2017 **Driver hand detection and tracking using Deep Learning with Gaussian Mixture Probability Hypothesis Density filter** *Sony*
Region based detector was used to detect and localize driver's hand position. Afterwards, filtered and smoothed the trajectory following several post-processing steps.

2016 **Gesture recognition using Cascaded classifier and $1 Unistroke Recognizer**
Implemented naive cascaded classifier to detect hands. Procedural approach was later used to define the start and end time of a gesture, and $1 Unistroke to classify the gestures.

2015 **Deep reinforcement learning to optimize interaction for a robotic tutor** *Research group: iLab/AAA*
Developed an Artificially intelligent agent (a robot) to play an interactive game, Enercities, using Deep Reinforcement Learning network. The network was fed with high-dimensional sensory raw data for both learning and selecting optimal action(s).

2015 **Multi Sensor Image Fusion and Tracking persons**
Implemented HOG features based people detection algorithm. Subsequently, used Kalman filter and multi camera fusion to improve the detection accuracy and compared the result with a Convolutional Neural Network based people detector.

2015 **PASCAL project: recognition of objects from a number of visual object classes in realistic scenes**
Surveyed performance of combinations of descriptors and classifiers, to recognize objects from PASCAL dataset. I surveyed a combination of SIFT and SURF features, with K-Nearest Neighbor, AdaBoost and SVC classifiers.

2015 **Extended Klaman Filter (EKF) based Simultaneous Localization and Mapping (SLAM) using ROS**
EKF based SLAM was implemented and later, demostrated on a turtlebot.

2015 **Medical Image Analysis Challenge: 3D Breast Ultrasound Image segmentation**
Developed an algorithm to segment 3D breast ultrasound images using Region Growing and Threshold Segmentation Level Set Image Filter.

2015 **Generate topological map using RPS and plan optimal path using A* algorithm**
Implemented Rotational Plane Sweep algorithm to create visibility graph of a simulated environment and next, A* algorithm to find an optimal path from the visibility graph.

2015 **Rapidly-Exploring Random Tree (RRT) to solve 2D path planning problem**
Implemented RRT algorithm to find path from a known simulated map and smoothed the trajectory using naive smoothing algorithm.

2015 **Tangent Bug algorithm implementation over a real e-puck robot**
Implemented Tangent Bug path planning algorithm and demonstrated on e-puck robot. The implementation was also extended to simulate a e-puck robot over V-REP simulator.

2014 **Spectral Mesh Analysis: Toward a simple implementation in C++**
Implemented Laplacian framework to model meshes on differential coordinate. Besides, designed a simple GUI using OpenGL shaders to animate the meshes.

Skills-Languages and Tools

Programming	Python, C/C++11 STL, Matlab
Frameworks	Tensorflow, Keras, Caffe
Libraries	OpenCV, Octomap, ROS, OpenGL, CUDA, ITK, VTK, PCL
Skills	Deep Learning, Probabilistic Machine Learning, Bayesian, Gaussian Processes, Convex Optimization, Reinforcement Learning, Object tracking, SLAM, Computer Vision, Medical Image Analysis
Tools	Qt, LaTeX, git, Mercurial, Scrum
OS	Linux, Windows

Awards

2014 - 2016	**Erasmus +: Erasmus Mundus Scholarship in Category A**, funded by European Commission.
2010	**Best Student Award** for Obtaining 1 st position in the year 2008.
2010 - 2012	**University Merit Scholarship**, awarded by RUET in 3 consecutive years.

Involvements

2010-2012	Member of **RSR (Robotic Society RUET)**
2010	Participated in **ACM-ICPC Dhaka Site**