USMAN AHMED SYED

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EDUCATION

University of Illinois at Urbana-Champaign (UIUC)
PhD in Electrical and Computer Engineering — CGPA: 3.75/4.00
Specialization: Optimization, Controls and Machine Learning

Master's in Electrical and Computer Engineering — CGPA: 3.80/4.00
Specialization: Controls and Robotics

National University of Sciences and Technology (NUST), Pakistan
Bachelors in Mechatronics Engineering — CGPA: 3.58/4.00

Research Interests:

Optimization, Reinforcement Learning, Flight control, Control Systems

Relevant Courses:

Control Systems Theory and Design	Analysis of Nonlinear Systems	Optimum Control Systems
Nonlinear and Adaptive Control	Random Processes	Geometric Control Theory
Advanced Robotic Planning	Interplay between Control and Machine Learning	Learning Based Robotics

EXPERIENCE

Research Assistant at University of Illinois, Urbana-Campaign — **May 2015 – Present**

Project: Online Non-stochastic Control vs. Retrospective Cost Adaptive Control, a Unified Algorithmic Perspective

- Study of the online optimization for adaptive controller design in the presence of unknown disturbances and a similar control theoretic framework called retrospective cost adaptive control (RCAC).
- Analyze the connections between online non-stochastic control and RCAC in the context of controlling linear systems subject to unknown non-stochastic disturbances.
- Synthesize a new online control algorithm by unifying the optimization and control-based approach and achieve improved performance guarantees.

Project: Tracking Error Analysis of Online Optimization Methods via Sequential Semidefinite Programs (SDPs)

- Proposed a unified framework for analyzing the tracking error of the first-order online optimization methods.
- Formulated tracking error problem as a sequential SDP
- Exact analytical solutions for the proposed sequential SDPs and refined bounds for the tracking errors of online optimization algorithms.

Project: Analysis of Temporal Difference (TD) based Reinforcement Learning Algorithms

- Study of on-policy TD learning algorithms and its variants as Markov Jump Linear Systems (MJLS)
- Synthesis of exact solutions for the Mean Square Error for on-policy TD Reinforcement Learning algorithms.
- Finite time analysis of off-policy TD variant; Emphatic Temporal Difference Learning (ETD) algorithm.

Project: Bat-inspired Flight Control for a MAV

- Study of biological bat landing from high-speed video data and synthesis of bat inspired control strategy for agile movements of a micro-air vehicle (MAV).
- Design of a lightweight MAV with an adjustable center of mass.
- Design of feedback control law and its implementation on the MAV with on-board sensing and control.

Teaching Assistant at University of Illinois, Urbana-Campaign — **Aug 2015 – Present**

- Conducted lab sessions for **Introduction to Robotics** covering Robot Operating System (ROS), manipulator kinematics and computer vision topics like camera geometry and object detection.
- Taught senior level **Control Systems** lab covering system identification and conventional and state space based control.

Teaching Assistant at COMSATS Institute of Information Technology, Pakistan **Jan 2014 – Jul 2014**

- Taught Electric Circuit Analysis lab sessions.

Teaching Assistant at NUST, Pakistan **Aug 2011 – Dec 2013**

- Taught labs for Object Oriented Programming and Data Structures using C++, Digital Image Processing using MATLAB, Instrumentation and Measurements, Electromechanical Systems and Solid Modelling.

Research Assistant at NUST, Pakistan **Aug 2011 – Dec 2013**

Project Title: Path Planning for Mobile Robots

- Developed a Neural network based approach for planning the shortest path between start and goal locations.
- Devised a drivable space detection scheme using an unsupervised neural network
- Simulated the path planning approach in Player-Stage using C++.
- Experimental validation on a mobile robot platform.

TECHNICAL SKILLS

- **Programming:** C, C++, Assembly, Python, MATLAB, Simulink, NI LabView.
- **Libraries/Platforms:** TensorFlow, OpenAI, ROS, Opencv.
- **3D solid modeling and analysis:** Creo, AutoCAD.

ACTIVITIES AND AWARDS

- Awarded Fellowship for master's in electrical engineering by COMSATS, Pakistan.
- Awarded rector's scholarship by National University of Sciences and Technology (2008-2011).
- Participated in National Engineering Robotics Contest 2009 & 2010.
- Delivered workshops on design and building of mobile robots and microcontroller programming.

PUBLICATIONS

- Bin Hu, Usman Ahmed Syed, "Characterizing the Exact Behaviors of Temporal Difference Learning Algorithms Using Markov Jump Linear System Theory", Advances in Neural Information Processing Systems (NeurIPS), 2019.

- Jonathan Hoff, Usman Syed, Alireza Ramezani, Seth Hutchinson, "Trajectory planning for a bat-like flapping wing robot", IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2019.

- Usman Ahmed Syed, Alireza Ramezani, Soon-Jo Chung, Seth Hutchinson, "From *Rousettus-Aegyptiacus* Landing to Robotic Landing: Regulation of CG-CP Distance Using a Nonlinear Closed-Loop Feedback", IEEE International Conference on Robotics and Automation (ICRA), 2017.

- Alireza Ramezani, Usman Ahmed Syed, Jonathan Hoff, Soon-Jo Chung, Seth Hutchinson "Describing Robotic Bat Flight with Stable Periodic Orbits", Conference on Biomimetic and Biohybrid Systems, 2017.

- Khurram Kamal, Senthan Mathavan, Tayyab Zafar, Imran Moazzam, Ahsan Ali, Usman Ahmad Syed, and Mujib Rahman, "Performance assessment of Kinect as a sensor for pothole imaging and metrology", International Journal of Pavement Engineering, 2016.

- Usman Ahmed Syed, Kunwar Faraz and Mazhar Iqbal, "Guided Autowave Pulse Coupled Neural Network based real time path planning and obstacle avoidance scheme for mobile robots", Robotics and Autonomous Systems, Elsevier, April 2014.

- Usman Ahmed Syed, Usman Ali Malik, Mazhar Iqbal and Kunwar Faraz, "A Guided Autowave PCNN for Improved Real Time Path Planning," in Proc. Of IEEE International Joint Conference on Neural Networks (IJCNN), 2013.

- Imran Moazzam, Khurram Kamal, S. Mathavan, Usman Ahmed Syed, M. Rahman, "Metrology and visualization of potholes using the Microsoft Kinect sensor", in Proc. Of 16th IEEE International Conference on Intelligent Transportation Systems (ITSC), 2013.

- Usman Ali Malik, Usman Ahmed Syed and Kunwar Faraz, "A self-organizing neural scheme for road detection in varied environments," in Proc. Of IEEE International Joint Conference on Neural Networks (IJCNN), 2011.