Vijaya Sai Krishna Gottipati

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I am currently a second year masters student at MILA, supervised by Prof. Liam Paull (primary) and Prof. Yoshua Bengio. My research interests include Robotics, Reinforcement Learning, Biologically plausible learning algorithms, cognitive AI. I am also International Master in chess.

Academic Qualifications

Montreal Institute For Learning Algorithms **Montreal**
Masters (research) in Artificial Intelligence, GPA: 3.9/4.0 *2017–2019*

International Institute of Information Technology **Hyderabad**
(***Hons in Robotics Research Center***) *B.Tech in ECE, ranked 2/40* *2013–2017*

Primary and Secondary Education **Vijayawada**
10th class, Central Board of Secondary Education, ***CGPA: 10/10*** *1999-2013*
ranked 2112 in JEE mains 2013 among 1.3 million aspirants

Publications

- **(Jun'16 - Sep'16)** *'Reconstructing Vehicles from Single Image:Shape Priors for Road Scene Understanding'*
  Accepted for **ICRA 2017** (IEEE International Conference on Robotics and Automation 2017). We have surpassed the state of the art results by **11.4%** and we are currently placed 5th in the KITTI benchmark dataset leader board (Team of 3)
  publication: https://arxiv.org/abs/1609.09468 .

- **(Ongoing)** *'Deep Active Localization'*

  Submitted for **RAL + IROS**. Actively choosing actions to minimize localization errors has been a long standing challenge in robotics. We built end-to-end differentiable models that performed better than classical methods on simulator and on real robots in terms of accuracy, robustness, transfer and time complexity. We are further trying to improve on robustness and hierarchical models (Team of 5)
  preprint: https://arxiv.org/abs/1903.01669
  code: https://github.com/montrealrobotics/dal

- **(Ongoing)** *'Deep Pepper: An expert iteration based chess agent under RL setting'*
  Utilizing hand designed features and expert (stockfish) evaluations for faster training of the self-play agent using Monte carlo tree search, we trained a deep reinforcement learning agent that plays chess(Team of 5).
  preprint: https://arxiv.org/abs/1806.00683
  code: https://tinyurl.com/pepper-code

Major Projects

- **(Ongoing)** *'Uncertainty Aware Intrinsic Motivation in RL'*
  In this paper, we postulate that exploration essentially amounts to reducing an agent's uncertainty about the environment. We leverage an ensemble of models to quantify model uncertainty and use the reduction in model uncertainty as the intrinsic motivation that guides exploration (Team of 2)

- **(Ongoing)** *'Maplite'*
  We develop a system for autonomous vehicle navigation in rural environments without detailed prior maps. We optimize on imprecise map nodes based on segmentation of road points using 3D Laser and demonstrate the performance on full scale autonomous vehicle. (colloboration between MIT, TRI, UdeM)

- **(Jan'18 - Apr'18)** *'Actor Critic Inspired GANs for Modeling Temporal Data Distribution'*
  We established that, mathematically, Generative Adversarial Networks (GANs) are a subclass of Actor Critic (AC) methods (which is a class of reinforcement learning algorithm). We thus converted the generative language modeling problem to AC setting and further proposed a novel method using Monte Carlo Tree Search (MCTS) to reduce the variance of estimates. (Team of 2)
  project report: https://tinyurl.com/DLT-ACGAN

- **(Sep'17 - Feb'18)** *'Analyzing Disentanglement in Variational Auto Encoder'*
  We proposed novel divergence metrics for achieving better disentanglement in latent space variables without compromising reconstruction accuracy, which can be used extensively for unsupervised learning. We also provide comprehensive analysis based on RKHS metric. (Team of 4)
  project report: https://tinyurl.com/VAE-report
  poster: https://tinyurl.com/VAE-pgm
  code: https://github.com/nithin127/nest-vae

- **(Sep'17 - Jan'18)** *'Neural SLAM'*
  As part of the DuckieTown course project, we tried to approach the SLAM (Simultaneous Localization And Mapping) problem by maintaining an implicit representation of the map using the novel (blurry read and write operations) 2D memory in Neural Turing Machine, which is learned along with A3C (Advantageous Asynchronous Actor Critic) networks in an end-to-end differentiable model. (Team of 3)
  poster: https://tinyurl.com/NeuralSLAM

- **(Jan'17 - Jun'17):** *'Road segmentation and obstacle detection using deep learning'*
  The goal is to solve the research problem of segmenting road from other objects to facilitate efficient lane detection, curb detection, pothole (characteristic of Indian roads) detection, motion of pedestrians etc. We are leveraging the recent success of 'ReSeg' to take advantage of the temporal information. (Team of 3)

- **(Mar'15 - Jul'17):** *'The Mahindra Rise Autonomous Car Challenge'*
  As a core researcher in the "Team Swahana", and as part of honors degree at Robotics Research Center, I led the Computer Vision and Machine Learning team of researchers over 2 years in various problems like Traffic sign and signal estimation and recognition, Lane Detection, road plane parameter estimation and obstacle segmentation, stereo camera calibration and obtained SOTA results in these tasks which are now being utilized in **the 'Swahana' car** for the autonomous driving challenge in India (Team lead, Team of 8)

- **(Sep'16-Dec'16):** *'Efficient Object Proposals'*
  We have incorporated Deep Neural Networks in the existing approach for Detecting Temporally Consistent Objects in Videos through Object Class Label Propagation using RNNs. This approach was later used in automatic boundary extraction, given any input image (Team of 3)
  project report: https://tinyurl.com/ObjectProposal

- **(Aug'16-Dec'16):** *'Square Piece Jigsaw Puzzle Solver'*
  As part of independent study program with Dr.Vineet Gandhi, I solved the square piece jigsaw puzzles by "best buddies" method. Also, various other puzzle solving techniques(graph-based, tree-based, growing consensus using dynamic programming) were investigated as part of the study.
  project report: https://tinyurl.com/JigsawSolver
  code: https://github.com/saikrishna-1996/Jigsaw-Puzzle-Solver

Pet Projects and Course Projects

- Robot SLAM and navigation in indoor environments using turtle bot (2015)
- Robotic arm for Badminton robot (for Robocon 2015)

- Smart 2D speaker curtains and wetness detector (as part of the **MIT Media Labs** Design and Innovation workshop 2015)

Skills and Courses

- **Languages/Libraries:** Proficient in: C, C++, python, pytorch, MATLAB, OpenCV, ROS
- **Most Relevant Courses:** Deep Learning Theory (A+), Reinforcement Learning (A+), Probabilistic Graphical Models (A), Computer Vision (A), Digital Image Processing (A), Mobile Robotics(A)

Positions Assumed And Other Scholastic Achievements

- **Teaching Assistant:** for Science-1 **(Monsoon 2016)**. class of 250 students
- **Teaching Assistant:** for Science-2 (**Spring 2017**). class of 200 students
- **Machine Learning Intern: (December 2015 - January 2016)** at Speech lab in IIIT-H, I have worked on the voice conversion problem. I have specifically worked on training the LPCC features using Deep Neural Networks in Theano. The team later participated in the Voice Conversion Challenge 2016
- **Research Member: (April 2015 - July 2017)** Team Swahana, working on India's most cost-efficient self-driving car for Indian roads. Also, participating in the prestigious $1,000,000 Mahindra driverless challenge (Team of 22: Collaboration between IIIT-H, Uurmi systems and Mathworks)
- **Team Member: (April 2014 - August 2016)** successfully prototyped "cost-efficient and more secured ATM transactions using visible light communication" and won $30,000 in the prestigious ICICI trinity Innovation and Entrepreneurship contest 2014 (Team MFLTs: Mobile Flash Light Transactions); Also prototyped "human detection in crowded places" using image processing techniques and binary SVM as part of the same contest in 2015.
- **Organizer: (March 2018 - Present)** Robotics Reading Group at Mila
- **Organizer: (March 2018 - Present)** Tea talks at Mila https://mila.quebec/en/cours/tea-talks/
- **Chess: (2003-2018) International Master**, FIDE master, medal winner of various World, Asian, Commonwealth and National youth chess championships