

# Ganga Meghanath

DATA & APPLIED SCIENTIST, MICROSOFT BENGALURU

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## EDUCATION

**Indian Institute of Technology Madras**  
*Bachelor of Technology in Electrical Engineering*  
*Minor: Data Analytics*

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## INTERESTS

Reinforcement Learning, Deep Learning, Game Theory, Computer Vision & Robotics

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## PREPRINT

Ran Xu, Jinkyu Koo, Rakesh Kumar, Peter Bai, Subrata Mitra, **Ganga Meghanath**, Saurabh Bagchi. “[ApproxNet: Content and Contention Aware Video Analytics System for the Edge](#)”.

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## PROFESSIONAL EXPERIENCE

### Microsoft - Data & Applied Scientist, Bengaluru

(*Manager: [Rahul Agrawal](#), AI and Research, Microsoft, India*)

*Jun '19 - Present*

- Aim* : Detection, rejection and removal of adversarial attacks on multi-media advertising such as Product Ads displayed anywhere by Microsoft that violates editorial policies.
- Developed effective data-mining techniques for sampling data that constitutes  $\sim 1$  in  $10^6$  of the total number of incoming ads, where within each rare class there exists highly skewed diverse categories.
  - Built Image-Text classifiers over multi-label space, trained on in-house data with extensions to state of the art Deep Learning architectures such as MobileNet, EfficientNet, CDSSM, BERT, etc.
  - Developed and shipped models that can scale to billions of ads, ensuring nearly 99.9999% coverage, and at present processes close to 100 million incoming ads per day.

### Purdue University - Summer Intern, Dependable Computing Systems Lab

(*Guide: [Prof. Saurabh Bhagchi](#), Department of ECE, Purdue University*) *May '18 - July '18*

- Aim* : To create an architecture that enables runtime approximation during analytics on live video, captured at the edge device, using a single Deep Neural Network model.
- Trained the local executor offline on AWS EC2 instance, a ResNet-34 model with 6 output ports and Spatial Pyramidal Pooling to handle inputs of variable sizes (down-sampled frames).
  - Evaluated the model on the NVIDIA Jetson TX2 embedded board to classify frames (30 runtime approximation tuning depending on image complexity and accuracy/latency requirements.).
  - Created videos to demonstrate how ApproxNet adapts to different resource contention at runtime (paper available on [arXiv](#); videos available at [approxnet.github.io](#)).

### PhotoGurus - Summer Intern, Cochin

(*Guide: [Laurent Martin](#), Co-Founder and CTO, PhotoGurus*)

*May '17 - Jul '17*

- Aim* : To develop an architecture for auto-tagging and auto-selection of photographs using face similarity metrics and aesthetic rankings.
- Integrated AWS Rekognition APIs into the company's Rest Framework using Boto3 SDK & Python.
  - Processed over 3 lakh images through Rekognition and EyeEm vision API and analysed the stored results on mongodb using the rankings, image tags, face details and orientation corrections.
  - Created and analysed montage visualisations of extracted faces from the images categorized based on attributes such as 'emotion', 'smile', etc (sample available [here](#)).
  - Gave a presentation on future applications of AWS Rekognition in this domain ([Slides](#)).

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## TECHNICAL SKILLS

**Programming Languages:** Python, C/C#/C++, Tensorflow, MATLAB, Assembly (ARM)  
**Embedded Systems:** Arduino, FPGA, Raspberry Pi, Atmega8.  
**Operating Systems:** Linux(Ubuntu), Microsoft Windows.  
**Other:** Robot Operating System (ROS), OpenCV, Amazon Rekognition, MySQL, L<sup>A</sup>T<sub>E</sub>X.

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### Modeling Ecological Populations\* - Game Theory

(Guide: [Prof. Puduru Viswanadha Reddy](#), Department of EE, IIT Madras) Mar '19 - Apr '19

- Aim* : To study the population convergence of N-player Hawk-Dove game using learned strategies.
- Developed static N-player Hawk-Dove game with interaction dependent pay-offs at each stage.([Slides](#))
  - Studied convergence of the population w.r.t to MSNE using different strategy models & interactions.
  - Injected inherent cooperation through code-of-conduct giving higher population pay-off than MSNE.
  - Future work involves quantifying rewards of cooperation & using Informed Reinforcement learners.

### Improving robustness of neural networks against adversarial attacks - IIT Madras

(Guide: [Prof. Mitesh Khapra](#), Department of CS, IIT Madras) Oct '18 - Feb '19

- Aim* : Study of Adversarial attacks and Defence techniques for Machine Learning models.
- Conducted an exhaustive literature survey on state-of-the-art adversarial sample generation techniques and defense methods for DNNs (Graphs available at [1.Attacks](#), [2.Defense](#), [3.Overview](#)).
  - Successfully developed *Non-targeted* adversarial attacks and formulated reactive and proactive defence techniques for improving the robustness of visual question answer model TGIF-QA.
  - Future work involves developing an effective defense method with high success rate on most attacks.

### Memory based Multi-tasking A3C Agent\* - Topics in Reinforcement Learning

(Guide: [Prof. Balaraman Ravindran](#), Department of CS, IIT Madras) Jul '18 - Dec '18

- Aim* : To build a memory-incorporated RL framework that can learn to do Multiple tasks through active learning, and effectively reduce catastrophic forgetting on a set of Atari Games.
- Conducted a study on multi-tasking algorithms and existing techniques for incorporating a form of memory in RL agents (One page summary available [here](#)).
  - Established empirically that query-retrieval based memory (adapted from [RMQN](#)) improves the performance of an agent on single and multiple tasks by implementing three different agents augmented with memory and comparing their performances with memory-less agents.
  - Built a Multi-tasking architecture called *Modularised Recurrent Memory-A3C* (MRM-A3C) that has a better regret optimality, sampling efficiency and performance, compared to its A3C baselines.
  - Future work involves evaluating MRM-A3C on different combinations of games to check for negative transfers & challenging domains requiring short term memory and context vectors.

### A Hierarchical Approach to Multi Tasking\* - Reinforcement Learning

(Guide: [Prof. Balaraman Ravindran](#), Department of CS, IIT Madras) Feb '18 - May '18

- Aim* : To study and evaluate the performance Hierarchical Reinforcement Learning frameworks in multi-tasking domains using active sampling.
- Evaluated the performance of [dmakian](#) implementation of *Feudal Network* architecture (to generate temporally extended sub-policies) on multiple Atari games using OpenAI Gym environment.
  - Integrated multi-tasking algorithms: Adaptive Active Sampling, Doubling UCB and Doubling DQN for active selection of games during training into *Option Critic* architecture using ALE.
  - Future work involves using prioritized experience replay for Doubling DQN and simultaneous assignment of CPU threads for all the games based on selection probabilities.

### Weather data summarizer using encoder-decoder networks\* - Deep Learning

(Guide: [Prof. Mitesh Khapra](#), Department of CS, IIT Madras) Apr '18 - May '18

- Implemented a table summarizer for structured weather data using an encoder-decoder model comprising of an attention layer over a hierarchical bidirectional LSTM based encoder and LSTM decoder.
- Compared its performance to a uni-directional LSTM encoder-decoder model using BLEU-4 score.

### Word embeddings for native languages\* - Deep Learning

(Guide: [Prof. Mitesh Khapra](#), Department of CS, IIT Madras) Mar '18 - Apr '18

- Scraped data from over 30 websites to successfully construct a corpus of ~15 million words in the Indian native language Malayalam (Corpus available [here](#)).
- Performed a comparative study on the effectiveness of existing word2vec models on the corpus.
- Developed custom metrics and test cases in Malayalam for model evaluation.

**Team Anveshak, University Rover Challenge - Center For Innovation (IIT Madras)**  
(Guide: *Prof. T Asokan, Department of Engineering Design, IIT Madras*) Oct '16 - Jun '17

*Aim* : To build a remote operated all-terrain rover, complete with a robotic manipulator and digger, with an in-built autonomous navigation module. ([Website](#))

- One of the 3 teams from India to get selected for University Rover Challenge held by Mars Society in Utah, finishing 29th out of 70+ teams from across the world at URC 2017 in our debut attempt.
- Developed novel heuristics for path planning for autonomous 6 wheel drive systems.
- Developed ROS meta-packages in C++ and Python, interfacing the robotic manipulator and on-board drive systems for seamless control.
- Implemented Computer Vision algorithms for identification and estimation of object distance, and a custom built radar using ultrasonic sensors.

\* *Course Project*

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RELATED  
COURSEWORK

**Data Science**

- CS7015: Deep Learning
- CS6700: Reinforcement Learning
- CS4011: Principles of Machine Learning
- CS7011: Topics in Reinforcement Learning
- ID7123 : Machine Intelligence and Brain Research

**Other Relevant Courses**

- EE6418: Game Theory
- EE3004: Control Engineering
- ID6040 : Introduction to Robotics
- BT6270: Computational Neuroscience
- EE4371: Data Structures and Algorithms

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LEADERSHIP  
EXPERIENCE

**Class Representative - B.Tech Electrical Engineering, IIT Madras**

- Elected to represent a batch of 130 students in the Class Committee and Department meetings.
- Successfully coordinated an additional course on Probability after much deliberation with the Dean of Academic Courses and the Head of the Department of Electrical Engineering.

**National Service Scheme, India**

- Taught Science and Math to underprivileged school students by conducting classes.
- Produced live video recordings on the usage of internet services for housewives and school students.
- Actively participated in collection drives for food and clothes for the underprivileged.

**Academic Mentor - Saathi, IIT Madras**

- Coordinator for a team that endeavors to identify challenges faced by the student community.
- Mentored 4 freshman from the Department of EE during the course of their first academic year.

**Coordinator - Saarang'17, IIT Madras**

- Coordinator for Saarang, one of the largest, completely student run, non-profit college fests in India.
- Organized a series of 3 different workshops and a live demonstration with the winner of "Culinary Olympics", Chef Umashankar and competitions judged by celebrity chef Vicky Ratnani.

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EXTRA &  
CO-CURRICULAR  
ACTIVITIES

- Trained Classical *Bharatnatyam dancer* under the tutelage of Kalamandalam Smitha.
  - Runner up in the *Big Data Challenge* conducted by *American Express* during Shaastra 2018.
  - Winners on public leader-board and runners up on private leader-board among ~30 teams, for the *Kaggle contest* held as part of the Machine Learning coursework.
  - *Head Volunteer* for the Hostel during *Tech-Soc* (the Inter-Hostel Technical Competitions of IIT Madras) with prominent events: Manual Robotics, Autonomous Robotics & Reverse Coding.
  - Participated and successfully completed the *Terry Fox Run* to spread awareness about cancer.
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