Meghana Venkata Palukuri
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Education

Program	Institution	GPA	Year	Rank
MS & Ph.D. in Computational Science, Engineering & Mathematics	The University of Texas at Austin	3.76/4	2022	-
B.Tech (*Honors*) & M.Tech in Chemical Engineering	Indian Institute of Technology Madras	8.94/10	2017	2

Research Interests

I am passionate about developing **machine learning algorithms** to solve the world's most challenging problems.
Areas: Machine Learning **(Deep Learning, Reinforcement Learning), Optimization, Graph theory**

Coding Skills

Python (scikit-learn, nltk, networkx, igraph, dgl, stellargraph, pandas, geopandas, numpy, scipy, keplergl, pyspark, faiss, pytorch, tensorflow), **SQL** , **C++** (GRVY, MASA, HDF5, PETSc), **R** (tidyverse), **Matlab** (Statistics & ML, Optimization, ODE Solvers), **Scala**, **Latex**, **Linux**, Unix, **AWS** (S3, EC2, Sagemaker, Redshift, Comprehend), **HPC** (at TACC), Google Cloud, Travis-CI, autotools, Valgrind, Docker, C, Java, Arduino-coding, HTML, CSS, Javascript, C#,[Github]

Select Graduate Course Work

- **Statistical Models for Big Data** (incl. Regression Analysis)
- Tools & Techniques in Computational Science
- Geometric Foundations of Data Science & Optimization
- **Reinforcement Learning**
- Deep probabilistic modeling
- Pattern Recognition
- **Bayesian Deep Learning**
- Functional Analysis
- Graph Theory

Professional Experience

- **Applied Scientist, Amazon (Last Mile Science),** *Project: Route Planning* Aug 2022 - present
  - Built road network communities as a **new geospatial planning unit** for many applications using graph algorithms.
- **Graduate Research Assistant, University of Texas at Austin** Jun 2018 - Aug 2022

(Supervisor: Prof. Edward Marcotte - Oden Institute for Computational Engineering and Sciences)
  - Worked on **Ph.D. Thesis** titled 'Machine Learning methods for community detection in networks using known information'.
  - Developed **Super.Complex**, a **distributed, supervised AutoML method** achieving **98% accuracy** in protein complex detection.
  - Developed a **fast reinforcement-learning algorithm** with **graph embeddings** for **community search**, an **NP hard problem**.
- **Concentration in Teaching and Mentoring**, Texas Institute for Discovery Education in Science Jun 2018 - present
- **Professional Memberships: Society for Industrial and Applied Mathematics**, SBE, AICHE 2017 - present
- **Applied Scientist Intern, Amazon (Last Mile Science),** *Project: Route Planning* Jun - Aug 2021
  - Accurately **forecasted productivity** of delivery routes using **AutoML**, and **selected features** to influence for improvements.
- **Applied Scientist Intern, Amazon (Brands Experience),** *Project: Substitute Product Recommender* Jun - Aug 2020
  - Built **product embeddings** using catalog **text** and performed **fast neighbor search** for substitute products with **99%** Recall.
- **Cloud Software Engineering Intern, Schlumberger**, *Project: Time-Series Operations* Jun - Aug 2019
  - Developed a **Domain Specific Language** in **Scala** for **custom calculations** on real-world **time series data** on **Google Cloud**.
- **Graduate Assistant, Indian Institute of Technology, Madras** 2016-17
  - Worked on Master's thesis titled 'Human bio-chemical reaction network analysis for treating autism'.
  - Developed **two constrained pareto-optimization algorithms** and **two metrics** for optimal **network flow distribution**.
- **Intern, Hindustan Unilever**, *Project: Autonomous Maintenance* May-Jul 2015
  - **Improved process energy efficiency by 20%** by eliminating an identified stream through **modification of system logic**.

Research Projects (ML, HPC & Optimization)

- **AutoML image clustering with similarity graph embeddings [Code]** Jan-May 2022
  - **Combined image and similarity graph embeddings** of 2D projections and clustered them into 3D objects (**97% accuracy**).
- **Protein complex classification with graph neural networks [Code]** Sep-Nov 2021
  - Tuned 6 **graph neural networks** for imbalanced **binary graph classification** as protein complexes or not with **86% accuracy**.
- **Graph theoretical feature selection for protein complex classification** Jan-May 2019
  - Selected 18 graph-theoretical features **achieving 0.97 APS** in binary classification with **PCA**, **glmstep** and **logistic regression**.
- **Laplacian finite difference solver application** Aug-Dec 2018
  - Developed from scratch a **C++ application** leveraging **solvers** for the **2D** heat equation, achieving **high convergence rates**.
  - **Features**: **performance - 0.4s** (100x100 mesh), **100%** code coverage (**lcov**), **0** memory errors (**Valgrind**), **HPC** environment.
- **Hyperspectral image denoising and classification [Code]** Mar-May 2018
  - Applied a framework with **one-against-one and one-against-all SVMs** for **multi-class** classification with **90% accuracy**.
- **Re-ranking molecule docking poses with RankSVM** Oct-Dec 2017
  - Formulated and implemented a **novel SVM classifier for re-ranking docking poses** from F2-dock with **75% accuracy**.
- **Implementation of ML algorithms for image and speech data classification [Code]** Aug-Dec 2016
  - Built **neural networks, GMM, HMM, Bayes, k-means and k-nn classifiers** for speaker identification and image recognition.
- **Kinetic modeling of anti-cancer drug action** Jul 2016-May 2017
  - **Simulated experimental circadian rhythms** with a **robust data-tuned parametric model** using a **genetic algorithm**.
- **Design of microfluidic networks performing floating point operations** Jul 2015-Jun 2016
  - Employed **genetic algorithms and MINLP** to **design optimal micro-fluidic networks** for **combinatorial sequence sorting**.

Publications & International Conferences

6 papers including 3 peer-reviewed journal papers, 8 conferences, with 25 citations and h-index 3. [**Google Scholar**]

- Palukuri MV (2022) Machine learning methods for community detection in networks using known information **[Thesis]**
- Palukuri MV, Patil RS and Marcotte EM (2022) Molecular complex detection in protein interaction networks through reinforcement learning **bioRxiv**: 496772. **[Paper]**
- Mohammad FK, Palukuri MV, Shivakumar S, Rengaswamy R and Sahoo S (2022) A Computational Framework for Studying Gut-Brain Axis in Autism Spectrum Disorder. Front. Physiol. 13:760753. **[Paper]**
- Palukuri MV, Marcotte EM (2021) Super.Complex: A supervised machine learning pipeline for molecular complex detection in protein-interaction networks. PLoS ONE 16(12): e0262056. **[Paper]**, **bioRxiv**: 449395 **[Paper]**
- Palukuri M, Marcotte EM (2021) "Super.Complex v3.0: A Supervised Machine Learning Pipeline for Molecular Complex Detection in Protein-interaction Networks", ***US HUPO*** *(**Human Proteome Organization** Conference)* **[Poster]**
- Palukuri M, Marcotte EM (2020) "Super.Complex: **Intelligent subgraph search** for communities with **deep reinforcement learning**", ***SIAM MDS****: Conference on **Mathematics of Data Science***, Cincinnati **[Invited Talk]**
- Palukuri M, Marcotte EM (2019) "**Super.Complex**: A Computational Pipeline for Supervised Community Detection in Graphs", ***TACCSTER 2019****: TACC Symposium for Texas Researchers*, Austin **[Invited Talk, Poster]**
- Palukuri M, Marcotte EM (2019) "Supervised community detection in protein-interaction networks", *The 2nd Annual Meeting of the SIAM Texas Louisiana Section)*, Dallas **[Best Poster Award]**
- Palukuri M, Marcotte EM (2019) "Supervised community detection", *Workshop on Recent Developments on **Mathematical/ Statistical approaches** in **Data Science** (MSDAS)*, Dallas **[Poster]**
- Kizhuveetil U, Palukuri M, Karunagaran D, Rengaswamy R, Suraishkumar GK. (2019)"Entrainment of superoxide rhythm by menadione in HCT116 colon cancer cells", ***Scientific Reports, Nature Publishing Group*** 9.1: 3347 **[Paper]**

- Palukuri M, Shivakumar S, Sahoo S, Rengaswamy R. (2018) "Computational framework for exploring the interplay of diet and gut microbiota in autism." ***bioRxiv***: 422931 **[Paper]**
- Palukuri M, *et al*. (2018)"An integrated COBRA-PBPK model to study interactions between gut and brain in autism", ***5th Conference, Constraint-Based Reconstruction and Analysis***, Seattle **[Poster]**
- Kizhuveetil U, Palukuri M, Rengaswamy R, Suraishkumar GK. (2017) "Menadione induced reset of circadian superoxide rhythms in human colon cancer cells", ***Free Radical Biology and Medicine, 112***, 91-92, Baltimore **[Poster]**
- Palukuri M, *et al*. (2017) "Predicting the role of gut microbiota and diet in autism", ***11th Copenhagen Bioscience Conference: "Data-Driven Biotechnology***: Bench, Bioreactor, Bedside" , Hillerϕd **[Poster]**
- Palukuri M, Shivakumar S, Sahoo S, Rengaswamy R. (2016) *"Predicting the role of gut microbiota and diet in autism"*, **Interdisciplinary Laboratory for Data Sciences Workshop**, Chennai **[Poster]**

Awards & Honours

- Passed **Ph.D candidacy exam** & **Ph.D preliminary exam** (applicable math, scientific computing, math modeling).
- **O'Donnell Fellowship** and **General ISSS Financial Aid** award ($34k) by UT Austin towards research. (2017-19)
- **Two-time** $500 **Professional Development Award** and **25% discount** given to present at two conferences. (2018-20)
- Selected for admission to graduate studies at **UT Austin, CMU** and the **University of Delaware**. (2017)
- Received the **C.A. Sastri Endowment Award** for best graduating chemical engineering student. (2017)
- Selected for the **KVPY Fellowship** awarded by the Department of Science and Technology, Govt. of India. (2012)
- **1 out of 6** students from 90 chemical engineering students to be awarded a **B.Tech Honours** degree (2017)
- Qualified for nationals **(top 5%)** of **International Chemistry Olympiad** hosted by HBCSE (TIFR). (2012)
- Secured undergrad admission at IITM, the **best engineering college** in India (**top 0.5%** of 500k applicants) (2012)
- Secured All India Rank of **34** in **National Science Olympiad**, **64** in **International Math Olympiad**. (2006,2012)

Co-curricular Activities

NLP	Ranked **2nd** in sentiment classification of Amazon reviews with word embeddings & logistic regression. Built human protein embeddings (from sequences) with **ProtBERT** for complex representation. (2021)
Coding	**Windows App(C#): Wardrobe Assistant- outfit suggestions** *2016 **Microsoft**-24hr Code.Fun.Do Hackathon*
Robotics	Coded locomotion for **autonomous transwheel** robot 2013 **Asia-Pacific Robot Contest - Robocon**
VR	Designed **spatial augmented reality** at Envisage, India's largest student tech show:**2000+ people** (2014)
Table Tennis	**UT Austin TT Team Member**: Participated in USA **nationals** by **NCTTA**, securing **7^{th}** place. (2018-19) **IITM TT Team Captain:** Won **Gold Medal**- Sportsfest, **Silver Medal**-**48^{th} Inter-IIT Meet**. (2012-16)
Chess	Placed **1^{st} in Intra-hostel Chess** Competition, **4^{th}** in Dean's Trophy. (2013,2015)
Classical Arts	Learnt **Carnatic music** for **7 years**, classical **dance** forms Bharatnatyam and Kuchipudi for **3 years** Selected for the **Guinness World Record** event, **'Laksha Gala Sankeertanarchana'**. (2009)

Volunteering

- **Two-time Captain Judge** at the Dallas Regional **Science and Engineering Fair** for middle-class students. 2019-20
- Information desk volunteer at **Explore UT** - campus wide event to promote learning attended by 1000+ people. 2019
- **Organized IITM** campus engineering facilities **tours and workshops** for middle **school kids**. 2015-16
- **Organized Run for a Cause**, event for **Chennai flood relief**, with proceeds going to **school repairs**. 2015-16

Leadership Positions

- **Vice President, SIAM Chapter of UT Austin** (2020-2021)
- **Founder, Literary Fest 'Saahitya'** *(a self-driven initiative, commended by the Director, Dean and Alumni)* (Feb - Apr 2016)
  - Formed & lead a **team of 60** across 6 divisions to **organize a literary fest with 30 events** and a **footfall of over 1000** in IITM.
- **Secretary, Chemical Engineering Society** *(Nominated by Dept. Faculty)* (2015 - 2016)
  - **Lead a team of 120 people** across 9 divisions to organize **'ChemClave'** (dept fest), with a footfall of around **1000** students.

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