# Santhosh Manohar Gouda Patil

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## EDUCATION

**Indiana University, Bloomington** AUG 2022 – MAY 2024
Master of Science in Data Science; GPA: 3.93/4.0

**R V College of Engineering, Bengaluru, India** AUG 2016 – JUN 2020
Bachelor of Engineering in Computer Science and Engineering; CGPA: 8.04/10

## SKILLS

- **Languages:** Python, R, C++, HTML, CSS, SQL
- **Databases:** PostgreSQL, MySQL, MongoDB
- **Frameworks:** PyTorch, CUDA, Keras, Streamlit, FastAPI
- **Libraries:** TensorRT, NumPy, Scikit-learn, Pandas, OpenCV Matplotlib, NLTK, PIL, Multiprocessing, DDP, PySpark, SciPy
- **Cloud and DevOps Technologies:** AWS, Docker, Kubernetes
- Supervised and Unsupervised Learning, Bayesian Inference, Variational Inference, Time Series Forecasting, Sampling Methods
- **Generative AI**: Diffusion Models, Transformers, VAEs, GANs, Normalizing Flows, LLMs (Llama, GPT, BERT)
- Computer Vision, Natural Language Processing
- Other Skills: Weights & Biases, Tableau, Git, CI/CD

## WORK EXPERIENCE

**Graduate AI Research Assistant: Indiana University, Bloomington - Prof. Roni Khardon** MAY 2023 – present

- Led an innovative research project that integrates **Convolutional LSTM** and **Transformer models** to enhance the forecasting of tropical cyclone genesis in the Northern Pacific.
- Optimized Earthformer model's hierarchical **encoder-decoder structure** for accurate atmospheric predictions on tropical cyclone formation, integrating **cuboid attention** and **global vectors** to achieve a **15% drop in RMSE**.
- Implemented a Convolutional LSTM model to identify TC locations, enhancing Nowcasting capabilities through convolutional input-to-state and state-to-state transitions, achieving a **0.82 F1 score**.
- Crafted an efficient, high-accuracy **Ensemble** model with **multiprocessing** and **DDP** on Multi-GPU, reaching a **0.75 score for 42-hour forecasts**.
- Explored **probabilistic Bayesian** approaches for better **uncertainty estimation** and to reduce computational costs compared to ensembles.
- Improved forecasting **precision by 17%** through refinement of weather variables such as wind speed and temperature at different sea levels; employed a novel **Masked-Minmax normalization** technique for effective training and informed decision-making.

**Associate Software Developer: IBM Private LTD, India** JAN 2021 – JUN 2022

- Deployed a bespoke **ML churn prediction** model in Salesforce using **XGBoost** and Heroku Connect, outperforming Einstein AI and led to the development of targeted retention strategies, enhancing **predictive analytics by 13%**.
- Established a robust data management workflow for churn analysis, integrating automatic updates in Salesforce to leverage real-time insights.
- Developed a secure data retention policy to protect production data, **leveraging SQL** for effective data handling and compliance, minimizing unauthorized access risks.

**Research Assistant: Indian Institute of Science, Bengaluru, India - Prof. Raghu Krishnapuram** OCT 2019 - JUN 2020

- Crafted a sophisticated **U-Net**-based deep learning model for monocular **depth estimation**, incorporating innovative loss functions, which led to a **5% decrease in RMSE** and enhanced depth map quality on the KITTI benchmark, outperforming prior models.
- Pioneered efficient training methods with multi-scale sampling and a distinct **pose estimation** network for **self-supervised** learning, eliminating the need for ground truth depth.
- Led the exploration of **Visual Odometry** using **Deep Recurrent CNNs**, enhancing image sequence modeling for autonomous navigation; results demonstrated a **12% increase** in accuracy for real-time pose estimation.
- Optimized the **Mask R-CNN semantic segmentation** model, enhancing accuracy in object detection and classification within intricate visual settings, achieving a **20% improvement** in model precision.

**Research Intern: Indian Institute of Science, Bengaluru** JUN 2019 - JUL 2019

- Expanded the capabilities of the PolygonRNN Auto - Annotation model by incorporating the **YOLO Algorithm** for precise object recognition and classification, accelerating annotation **speed by 40%** and elevating overall annotation quality.

## PROJECTS

**NLP-Driven Market Sentiment & Valuation Analysis**

Developed a sophisticated NLP pipeline to enhance market sentiment and company valuation insights from SEC filings and financial news, integrating **Amazon SageMaker**, **Hugging Face**, Pegasus, and **FinBERT** with **CI/CD** in SageMaker Pipelines.

**Embedded Topic Modeling (ETM)**

Improved **topic modeling** accuracy and **posterior approximation** by combining word and topic embeddings with a **Variational Autoencoder** and analyzed LDA vs. ETM models using Topic Perplexity and Diversity for superior topic extraction.

**General Detection of Image Manipulation**

Engineered a cutting-edge deep learning model by integrating **Error Level Analysis** and **ResNeXt**, enabling highly accurate detection of image manipulation; outperformed industry norms and set new benchmarks in image forensics with a **94% accuracy** score.

**Global News Analysis for Stock Prediction**

Employed **financial-BERT**, which surpassed traditional statistical models by **26% in accuracy**, to enhance stock market predictions through analysis of 'r/worldnews' subreddit data, encompassing global news and economic events.

**Bayesian Approach to Movie Recommendation Model**

Refined and applied a **Variational Probabilistic Matrix Factorization** model for movie rating prediction, enhancing **performance by 10%** through strategic initialization and training of an **EM Algorithm**, with detailed assessment of RMSE improvements.