# Ashwin K Krishna

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## EDUCATION

| PROGRAM | INSTITUTE | CGPA / % | YEAR |
|---|---|---|---|
| B. Tech **Honors**: Chemical Engineering (**Minor- Computing**) | Indian Institute of Technology, Madras | **9.04** | 2024 |
| XII (CBSE) | Maharishi Vidya Mandir Senior Secondary School | **94.80%** | 2020 |
| X (CBSE) | Maharishi Vidya Mandir Senior Secondary School | **91.00%** | 2018 |

## SCHOLASTIC ACHIEVEMENTS:

- Currently in the **top 3** of B. Tech Chemical Engineering Department Rank List of Indian Institute of Technology Madras
- Awarded the prestigious **Charpak Lab Scholarship**- **one of the top 30** scholars in **India** in collaboration with Campus France
- Selected for '**IIT Madras Young Research Fellowship'** - **1 of 35** selected from **150+** applicants for **excellent research aptitude**
- Obtained the **Certificate of Merit** (**top 0.1%)** by **Maharishi Vidya Mandir** Senior Secondary School- **AISSCE**[I] Examination 2020
- Awarded **Distinction**-Mathematics('17), **Credit**-Science ('16,'17,'13,'11) & Mathematics ('16) in Macmillan-IAIS[II] by **UNSW Global**

## RESEARCH EXPERIENCE:

**Generative AI Innovation Center -2023-24** – *GenAI Leadership, Amazon | Aman Chada* **USA**

***Selected for proposing innovative problem statements of industrial and academic value***

*Open-set Multi Source Free Domain Adaptation:* *(Nov '23-Present)*

*Pioneer research focused on integrating aspects of **Multi-Source, Source-Free & Open-set** domain Adaptation for real-world use*

- Improved an existing **Multi-Source Free Domain Adaptation (MSFDA)** technique for open-set adaptation using **graph-learning**
- Currently tuning model performance on datasets: **Office, & Office-Home** for different variations of source feature combinations

*Robust Deepfake detection:*

*Leveraging vision techniques to improve **robustness** & to produce a **deepfake detector** with ability to classify **higher-class** of deepfakes*

- Aimed at building an architectural pipeline to produce augmented deepfakes for training and setting deepfake detection SOTA

**Charpak Lab Scholarship -** Université Paris Cité | Prof. Themis Palpanas **Paris**

*VUS Range based Time Series-Anomaly Detection metric:* *(May '23 – Aug '23)*

*Achieved **5X** optimization of **VUS-Anomaly Detection (AD) metric** by strategic enhancements in calculation methodologies*

- Provided algorithmic and conceptual improvements, for reducing **time and space complexity** by a quadratic factor
- Obtained a **sixfold** runtime reduction using efficient data structures, producing runtimes similar to the **Range-AUC metric**
- Created run-time and robustness study for **Synthetic and TSB-UAD Benchmark** by balancing loads across **3 Dino** servers using **10+** AD models including **Isolation Forest, Robust covariance, SVMs** & synthetically generated **near-perfect/worst** models

*Series2Graph Time Series Classification:*

- Employed **Series2Graph** to obtain time series features as graphs for **UCR-2018** to produce **Explainable-Graph classification**
- Currently tuning the modified **Graph Convolution Networks (GCNs)** for **Weighted-Directed Graphs** using torch geometric

**National University of Singapore (NUS)** | *Prof. Hongliang Ren* **Singapore**

*Leveraging surgical simulators for building **True Automation** to ensure aspects of **increased robustness** and **safety*** *(March '23 – Sept '23)*

- Integrated and improved **LapGym-SOFA** simulator to emulate **RosPy Publisher Subscriber** for efficient task control by **LLM**
- Combined **7+ surgical tasks**, reduced the latency & improved realism by utilizing **image based-RL techniques**
- Improved existing **AMBF-RL** simulator by building an **image extraction pipeline** for RL & a **universal controller** for all robots

**Young Research Fellowship -2022-23 (YRF)** - *IIT Madras | Prof. Himanshu Goyal* **Chennai**

*Pioneer research involving generation of **ML** based **Chemical Kinetic Model** for **Computational Fluid Dynamics** (CFD)* *(Sept '22 – April '23)*

- Created an efficient pre-processing and sampling pipeline to obtain data from **0-D statistical simulation** using **PaSR Simulator.**
- Successfully tuned an **ANN** based model to obtain accurate predictions for 34 chemical species with an **R2 score** of **>~ 0.996**
- Construed and fine-tuned a **bottleneck network** designed to reduce feature space of **Detailed Chemical Kinetic Models**

**Technical University of Munich (TUM)** | *Rachit Khare* **Germany**

*Pioneer research aimed at **accelerating** prediction of **X-Ray Absorption Fine Structure (XAFS)** by over **15+ hours*** *(June '22 – Sept '22)*

- Aimed at devising a model to formulate top **XAFS** estimates using **noisy-empirical data** of **X-Ray Absorption Spectroscopy**
- Employed simulations to **automate** and optimize the **feature space generation** of inputs to the prediction models
- Acquired **over ~ 0.95** base **R2 score** for testing data on Neural Networks (**ANNs)** for reduced feature space from **PCA**

## COURSE BASED PROJECTS:

1. **B. Tech Project- 2023 -24 (BTP)** – *IIT Madras | Prof Arun K Tangirala* **Chennai**

   *Pioneer research for **Explainable AI (XAI)** based reasoning for **Reinforcement Learning (RL)** in **Control Theory*** *(September '23-Present)*

   1.1. Integrated aspects of RL in optimal control of process dynamics and explainable AI in RL for integration.

   1.2. Implemented **4+** control systems for training with **DQN** and **DDPG** networks in **MATLAB Reinforcement learning toolbox**

   1.3. Implemented **XAI** strategies for mathematical interpretations of Deep Policy networks relating **response** to **kinetics**

2. **COLLOIDS:** *Classification of Colloidal **Drop Drying Pattern** using **Large Vision Models** |Prof. Basavaraja & Prof. Sumesh Tampi*

   2.1. *Generated Synthetic Data using OpenCV, along with data augmentation due to lack of experimental input data.*

   2.2. *Transfer Learning to adapt pre-trained vision models for the classification task and fine-tuning on experimental data.*

3. **ECOLOGICAL ENGINEERING:** *Mapping of Tree into Figs on IIT Madras Campus – for Ecological Sustainability | Prof. Susy Varghese*

## PROFESSIONAL EXPERIENCE:

**CONXAI X CNS Lab** | *Prof. Srinivasa Chakravarthy* **Germany**

*Leveraging **Explainable AI(XAI)** tools of the **$ 13 Billion** construction industry **by 30%** to **optimize** the costs and efforts* *(Aug 2021 - Mar 2022)*

- Brainstormed improvements in pre-existing floorplan segmentation analysis to improve results and convergence **by 50%**
- Aggregating streams of data varying from aspects of materials to construction equipment to facilitate **real-time predictions**
- Worked on using textual, room and room boundary details to create a **Bidirectional Graph-based segmentation module**

**Computer Vision and ML Engineer (AR Navi)** |*Toyota Connected India Limited (TCIN)* **Chennai**

*Engaged as an ML Engineer within the Vision team, instrumental in driving transformative initiatives* *(Jan 2021 - May 2022)*

- Adapted the **Yolopv2** model, transitioning it from **pt** to **TF-Lite and ONNX**, integrating it into a dynamic visual system
- Worked on generating an object detection pipeline to act as a wrapper connecting python models to other formats.
- Utilized cloud GPUs through **AWS** servers and contributed to project management activities through proficient use of **Jira**

**CVI Team:**

*1. Emotion Detection (2022-23)* : Improving robustness and speed for video-based emotion detection in **FER** repository with Justing Shenk
Achieved the same using faster face extraction models - **DSFD, MTCNN,** and **BlazeFace extractor**

*2. Joint Angle Estimation (2022-23)* : Coordinated on Literature review on papers of **Vision and Deep Learning Methods** for a team 3 members
Enhanced **Lightweight Joint Angle Estimation** to get **real-time joint angle estimates** by monocular lens

## COURSEWORK:

- Probability, Statistics & Stochastic Process (IITM)
- Linear Algebra for Engineers (IITM)
- Function of Several Variables (IITM)
- Series and Matrices (IITM)
- Discrete Mathematics for Computer Science (IITM)
- Introduction to Programming (IITM)
- Comp Programming & Process Simulation Lab (IITM)
- Computational Techniques (IITM)
- Pattern Recognition and Machine Learning (IITM)
- Data Structures and Algorithms (Coursera & CBSE)
- Process Dynamics and Control (IITM)
- French I (IITM)
- Audited Deep Learning Specialization (DeepLearning.ai/Online)
- Deep learning Masterclass (IITM/CFI)
- Robothink iBot Masterclass (IITM/CFI)
- DLI: Transformer-Based NLP Application (NVIDIA/Workshop)

## TECHNICAL SKILLS & KNOWLEDGE:

- Programming & Other Languages: Python, C, C++, Java, SQL, LaTeX
- Libraries: Pytorch, Keras, Tensorflow, Numpy, Pandas, Seaborn, Sci-kit
- Software: FUSION 360, Unity, Unreal 4.0, MATLAB

## PUBLICATIONS:

Submitted:

1. Paul Boniol, Ashwin K. Krishna, John Paparrizos, Themis Palpanas: *"VUS: Effective and Efficient Accuracy Measures for Time-Series Anomaly Detection"*, Very Large Databases Journal (VLDBJ), November '23
2. Ashwin Krishna Kumar, Lalithkumar Seenivasan, Gokul Adethya, Mobarakol Islam, Hongliang Ren: *"Exploring LLM Empowered Interactive Surgical Assistant for Surgical Sub-Task Automation"*, Nature Machine Intelligence Journal, December '23
3. Ashwin K Krishna, Racha Varun Kumar, Himanshu Goyal: *"Integrated Kinetic Models for Fluidized Bed Biomass Gasification using Machine Learning"*, The Energy Summit, December '23

Writing:

1. Ashwin K Krishna, Adithya K Krishna, Vinija Jain, Aman Chadha: *"Open-set Multi Source Free Domain Adaptation",* ECCV 2024
2. Ashwin K Krishna, Paul Boniol, Themis Palpanas: *"Series2Graph Time Series Classification"*, SIGMOD 2024

## EVENTS:

Presenter:

1. The Energy Summit 2023 – The Energy Consortium – Presenting: "Integrated Kinetic Models for Fluidized Bed Biomass Gasification using Machine Learning" and its applications in production of sustainable fuels.
2. "Alchemy", NIT Trichy- Conducted: AI/ML Workshop

Attendee:

1. DiNo Seminar – Speaker: Romain Ilbert: Memorizing Transformers
2. Data Intelligence Institute Paris (diiP)- Keynote speakers: Prof. Michael Franklin and Dr. S. Mostafa Mousavi
3. Laboratory of Informatics Paris Descrates, Open Day

## COMPETITIONS & EXTRA-CURRICULARS:

- Robothink IBOT Competition: Led a 4-member team to 3rd place finish, designing Autonomous fire extinguisher bot using FUSION 360
- E-Summit'22 IIIT Nagpur: Directed a 4-member to top 16 nationally, from 300+ (only team in IITM) for product ideation - Pitchers 3.0
- Kaggle Coding Challenge – Pattern Recognition and Machine Learning – Placed in top 10 for highest accuracy of prediction.
- **Isshinriyu Karate** - Martial Arts: Awarded 1st Dan rank of Black belt in BOFFUKKAI ISSHINRIYU KARATE form, at the age of 9.
- **Carnatic Music** - Undertook Carnatic music and violin training & have participated in several events and competitions.

## POSITIONS OF RESPONSIBILITY & SOCIETAL IMPACT:

1. Finance Team: Saarang '23 (Cultural Fest, 1.8 Cr+ budget and 70,000+ avg footfall) – Manager ('22-23) & Coordinator ('21-22):
   a. Interviewed, selected and trained juniors on aspects of Finance, Negotiation and budget management for the Saarang
   b. Coordinated the setting up of food stalls and ensured that all low-level vendors get adequate exposure and profits
   c. Helped setting up and budgeting for **social campaigns & initiatives** like **Mann, iVil, & workshops** throughout the year.
2. Mentored students and juniors from **IITM & NITT** in balancing academics, projects/internships and extra-curriculars
3. Volunteered in coordinating the organization of social drives by **HelpAge India 2017** for providing monetary aid for the elderly