Shreshth Tuli

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Academic Details

Year	Degree	Institute	CGPA/Percentage
2020-Present	Ph.D. in Computing	Imperial College London	-
2016-2020	B.Tech in Computer Science and Engineering	Indian Institute of Technology Delhi	9.48
2016	Class XII, CBSE	Amity International School	95.8%
2014	Class X, CBSE	Amity International School	10.00

Awards and Achievements

- **First Place** at the ACM SIGMETRICS Student Research Competition (Graduate Category). Details here.
- **Top reviewer** for the Wiley Software: Practice and Experience Journal as per Publons. Details here.
- Awarded the **President's PhD Scholarship** at the Imperial College London. Details here.
- Awarded **Kalpana Chawla scholarship** by the Government of India for contributions in research and scientific development
- **Institute Rank 1** for first year B. Tech at IIT Delhi with CGPA of 9.912 out of 800 enrolled students.
- Received **$5000 AUD grant** for developing **FogBus framework** at the Cloud Computing and Distributed Systems (CLOUDS) Laboratory, Department of Computing and Information Systems, the University of Melbourne, Australia.
- Received **DISA** (Design Internship Summer Award) and **DIT Seed Grant** for Air Purifier Project in Summer 2017.
- Placed among the **top 7 percent** of IIT Delhi in the first, second, fourth and seventh semesters based on academic performance.
- Won **2nd Runner's Up**, **Best Mechanical Design Award** and **Best Technical Report** Cash Prize for Bomb Disposal Robotics National Competition at IIT Kharagpur - December 2016
- Secured **All India Rank 611** in Joint Entrance Exam Advanced - 2016 among 150,000 candidates.
- Cleared **Kishore Vaigyanik Protsahan Yojana** (KVPY) National written exam and interview with All India rank 280 in 12^{th} standard.
- Received **Best Alliance award** and **Rockwell Collin's Innovation award** for National Robotics Competition - First Tech Challenge in 10^{th} standard. Competition link.
- Awarded **Second Runners Up** position and **Award for Best Marketing** in F1 in schools national competition in which students design, manufacture and race with miniature Formula 1 cars. Team Facebook page. Competition link.
- Awarded **Dhananjay Mohan Cup** for scientific innovation and creativity by school

Research Projects

Intelligent Placement of Split Neural Nets in Mobile Edge — Prof. Giuliano Casale and Prof. Nick Jennings

Research Project — Feb 2021 - Present

Deploying modern neural networks is challenging in the mobile edge computing paradigm, where edge nodes are resource-constrained, hence limiting the input analysis power of such frameworks. This work proposes an intelligent placement policy for the placement of semantic and layer-wise neural network splits on mobile edge hosts for efficient and scalable computing. GitHub Repository link.

Digital-Twin based Co-Simulation for Dynamic Scheduling — Prof. Giuliano Casale and Prof. Nick Jennings

Research Project — July 2020 - Present

To develop scheduling policies that can quickly and efficiently adapt in volatile environments with have low scheduling overheads, this work proposes a Gradient Based Optimization Strategy using Back-propagation of gradients with respect to Input (GOBI). Further, we leverage the accuracy of predictive digital-twin models and simulation capabilities by developing a Coupled Simulation and Container

Orchestration Framework (COSCO). Using this, we create a hybrid simulation driven decision approach, GOBI*, to optimize Quality of Service (QoS) parameters. GitHub Repository link.

Predicting the Trend of the COVID-19 Pandemic Self
Research Project Jan 2020 - Present
This study applies an improved mathematical model to analyse and predict the growth of the epidemic. An ML-based improved model has been applied to predict the potential threat of COVID-19 in countries worldwide. We show that using iterative weighting for fitting Generalized Inverse Weibull distribution, a better fit can be obtained to develop a prediction framework. This has been deployed on a cloud computing platform for more accurate and real-time prediction of the growth behavior of the epidemic. Prediction results link. GitHub Repository link.

Dynamic Scheduling in Fog Environments using A3C CLOUDS Lab, University of Melbourne
Summer Internship Research Project May 2019 - July 2020
Developed an A3C based real-time scheduler for stochastic Edge-Cloud environments allowing decentralized learning, concurrently across multiple agents. We use the R2N2 architecture to capture a large number of host and task parameters together with temporal patterns to provide efficient scheduling decisions. The proposed model is adaptive and able to tune different hyper-parameters based on the application requirements. GitHub Repository link.

FogBus CLOUDS Lab, University of Melbourne
Summer Internship Research Project May 2018 - July 2019
Developed a blockchain-based lightweight framework, named FogBus for Edge and Fog Computing, for end-to-end integration of IoT-Edge-Cloud. FogBus offers a platform independent interface to IoT applications and computing instances for execution and interaction. A Sleep Apnea analysis application also has been deployed using this framework for real time notification and diagnosis by analyzing pulse oximeter data. GitHub Repository link.

Coral Cloud Coral Telecom Ltd.
Industrial Project Jan 2018 - Jan 2019
Design and development of a High Availability (HA) and Load Balanced, Electronic Private Automatic Branch Exchange (EPABX) for SIP communication using Free-Switch open source software, secured by ISAKMP encryption.

Teaching Experience

Graduate Teaching Assistant at Imperial College London:

- Deep Learning *Jan 2021 - Mar 2021*
- Performance Engineering *Jan 2021 - Mar 2021*
- Operations Research *Oct 2020 - Dec 2020*

Undergraduate Teaching Assistant and IIT Delhi:

- Special Topics in AI (Robotics) *Jan 2020 - July 2020*
- Digital Logic and VHDL Design *July 2019 - Jan 2020*

Work Experience

- Graduate Teaching Assistant at Department of Computing, Imperial College London. *Oct 2020 - Present*
- Research Assistant as part of the RADON project. *April 2021 - July 2021.*
- Co-founder and Director at Qubit Inc. *Jan 2020 - Present*
- Research Associate at the CLOUDS Lab under the supervision of Prof. Rajkumar Buyya. *May 2018 - July 2019*
- Research Consultant at Manjrasoft India Pvt. Ltd. *Aug 2019 - Jan 2020*
- Research Consultant at Coral Telecom Ltd. *April 2016 - July 2020*

Reviewing

I have served as a reviewer for many journals and conferences. See my Publons profile at this link.

- Wiley: Software Practice and Experience (22)
- IEEE Access (4)
- IEEE Internet of Things (3)
- IEEE Transactions on Industrial Informatics (2)
- Wiley International Journal of Communication Systems (2)
- IEEE Transactions on Cloud Computing (1)
- IEEE Transactions on Dependable and Secure Computing (1)
- ACM Transactions on Software Engineering and Methodology (1)
- IEEE Communication Letters (1)
- IEEE Sensors (1)

Publications

Updated list of my publications with software repositories, datasets and preprint links can be found on my website.

Refereed Conference and Workshop Publications

C7. SIGMETRICS '21 — Shreshth Tuli. *SplitPlace: Intelligent Placement of Split Neural Nets in Mobile Edge Environments.* ACM SIGMETRICS, 2021. link. **First Place - Student Research Competition Poster** link

C6. IJCAI '21 — Shreshth Tuli, Rajas Bansal, Rohan Paul and Mausam. *TANGO: Commonsense Generalization in Predicting Tool Interactions for Mobile Manipulators.* International Joint Conference on Artificial Intelligence (IJCAI), 2021. [acc. rate: 13%]. link.

C5. RSS '20 — Shreshth Tuli, Rajas Bansal, Rohan Paul and Mausam. *ToolNet: Using Commonsense Generalization for Predicting Tool Use for Robot Plan Synthesis.* Workshop on Advances & Challenges in Imitation Learning in Robotics in Robotics Science and Systems (RSS), 2020. link.

C4. ISCAS '20 — Shikhar Tuli and Shreshth Tuli. *AVAC: A Machine Learning based Adaptive RRAM Variability-Aware Controller for Edge Devices.* IEEE International Symposium on Circuits and Systems, 2020. link

C3. ISCN '19 — Shreshth Tuli, Nipam Basumatary, and Rajkumar Buyya, *EdgeLens: Deep Learning based Object Detection in Integrated IoT, Fog and Cloud Computing Environments*, IEEE International Conference on Information Systems and Computer Networks, 2019. link.

C2. ICICC '19 — Riccardo Mancini, Shreshth Tuli, Tommaso Cucinotta, and Rajkumar Buyya. *iGateLink: A Gateway Library for Linking IoT, Edge, Fog and Cloud Computing Environments.* International Conference on Intelligent and Cloud Computing. link.

C1. Cloudcom '19 — Shreshth Tuli, Shikhar Tuli, Udit Jain and Rajkumar Buyya, *APEX: Adaptive Ext4 File System for Enhanced Data Recoverability in Edge Devices.* International Conference on Cloud Computing, 2019. link.

Refereed Journal Publications

J12. TPDS '21 — Shreshth Tuli, Shivananda Poojara, Satish N. Srirama, Giuliano Casale, and Nicholas R. Jennings. *COSCO: Container Orchestration using Co-Simulation and Gradient Based Optimization for Fog Computing Environments.* IEEE Transactions on Parallel and Distributed Systems (2021). link.

J11. ITL '20 — Shreshth Tuli, Sukhpal Singh Gill, Giuliano Casale, and Nicholas R. Jennings. *iThermoFog: IoT Fog based automatic thermal profile creation for cloud data centers using artificial intelligence techniques.* Internet Technology Letters 3, no. 5 (2020): e198. link.

J10. MedRxiv '20 — Shreshth Tuli, Shikhar Tuli, Ruchi Verma, and Rakesh Tuli. *Modelling for prediction of the spread and severity of COVID-19 and its association with socioeconomic factors and virus types.* MedRxiv (2020). link.

J9. IoT '20 — Shreshth Tuli, Shikhar Tuli, Rakesh Tuli, and Sukhpal Singh Gill. *Predicting the Growth and Trend of COVID-19 Pandemic using Machine Learning and Cloud Computing.* Internet of Things (2020). link.

J8.	TMC '20	Shreshth Tuli, Shashikant Ilager, Kotagiri Ramamohanarao, and Rajkumar Buyya. *Dynamic scheduling for stochastic edge-cloud computing environments using A3C learning and residual recurrent neural networks.* IEEE Transactions on Mobile Computing (2020). link.
J7.	ITL '20	Shreshth Tuli, Shikhar Tuli, Gurleen Wander, Praneet Wander, Sukhpal Singh Gill, Schahram Dustdar, Rizos Sakellariou, Omer Rana, *Next Generation Technologies for Smart Healthcare: Challenges, Vision, Model, Trends and Future Directions*, Internet Technology Letters. link.
J6.	IoT '20	Sukhpal Singh Gill, Shreshth Tuli, et al. *Transformative Effects of IoT, Blockchain and Artificial Intelligence on Cloud Computing: Evolution, Vision, Trends and Open Challenges*, Internet of Things, Volume 8. link.
J5.	JSS '20	Sukhpal Singh Gill, Shreshth Tuli, Adel Nadjaran Toosi, Felix Cuadrado, Peter Garraghan, Rami Bahsoon, Hanan Lutfiyya et al. *ThermoSim: Deep learning based framework for modeling and simulation of thermal-aware resource management for cloud computing environments.* Journal of Systems and Software (2020): 110596.
J4.	JSS '19	Shreshth Tuli, Redowan Mahmud, Shikhar Tuli, Rajkumar Buyya. *FogBus: A Blockchain-based Lightweight Framework for Edge and Fog Computing*. Journal of Systems and Software, Volume 154, 2019, Pages 22-36, link. **Top ten downloaded article of 2019 award** link.
J3.	FGCS '19	Shreshth Tuli, Nipam Basumatary, Sukhpal Singh Gill, Mohsen Kahani, Rajesh Chand Arya, Gurpreet Singh Wander, and Rajkumar Buyya, *HealthFog: An Ensemble Deep Learning based Smart Healthcare System for Automatic Diagnosis of Heart Diseases in Integrated IoT and Fog Computing Environments*, Future Generation Computer Systems Volume 104, 2020, Pages 187-200, link.
J2.	FGCS '19	Shreshth Tuli, Rajinder Sandhu, and Rajkumar Buyya, *Shared Data-Aware Dynamic Resource Provisioning and Task Scheduling for Data Intensive Applications on Hybrid Clouds using Aneka*, Future Generation Computer Systems 2019, link.
J1.	TECS '19	Sakshi Tiwari, Shreshth Tuli, Isaar Ahmed, Ayushi Agarwal, Preeti Ranjan Panda, Sreenivas Subramoney, *REAL: REquest Arbitration in Last Level Caches*, ACM Transactions on Embedded Computing Systems, Volume 18 Issue 6, November 2019.

Under review

- **Shreshth Tuli**, Sukhpal Singh Gill, Rajkumar Buyya and Peter Garraghan, Giuliano Casale, Nicholas R. Jennings, *START: Straggler Prediction and Mitigation Technique for Cloud Computing Environments using Encoder LSTM Networks.* IEEE Transactions on Services Computing.

Patents

- *Low Cost Air Purification System.* **Shreshth Tuli**, Shikhar Tuli, Sujeet K. Sinha, IIT Delhi. Filed at the Indian Patent Office. Date: 2^{nd} August 2017, Application Number: 201711027523
- *Combination Lock with limited trial and resetting mechanism.* **Shreshth Tuli**, Shikhar Tuli, Harshit Abrol, Shivang Dwivedi, Saujanya Chaudhary, Kargil Singh, Sivanandam Aravindan IIT Delhi. Filed at the Indian Patent Office. Date: 10^{th} August 2017, Application Number: 201711028520

Invited Talks and Workshops

- Talk given with keynote speaker Prof. Rajkumar Buyya at 4th IEEE International Conference on Internet of Things: Smart Innovation & Usage at Krishna Engineering College, Ghaziabad, India *18 April 2019.* Topic - Future of Fog and Cloud computing systems.
- Workshop and tutorial on Aneka PaaS given at Indira Gandhi Institute of Technology, Sarang, Orissa, India on *25-27 September, 2019.*

Courses

- **Computer Science:**
  Artificial Intelligence, Machine learning, Reinforcement Learning*, Computer Networks, Operating Systems, Parallel Computing, Theory of Computation, Algorithm Design, Programming Languages, Computer Architecture, Design Practices, Data Struc-

tures & Algorithms, Discrete Mathematics, Digital Logic, Syntheses of Digital Systems*, Kernel Hacking*, Deep Learning*, Performance Engineering*, Operations Research, Robotics*.

- **Mathematics and Electrical:** Signals & Systems, Semiconductor physics, Prob. & Stochastic Processes, Calculus, Linear Algebra, Operations Research*.

* : Graduate level course

Technical Skills

- **Programming Languages:** C, C++, Perl, Python, Java, JavaScript, OCaml, SML, Prolog, VHDL, Verilog, C#, F#, Visual Basic, Matlab, SQL, ARM, UML, HTML, CSS, PHP.
- **Frameworks:** FogBus, Aneka, CloudSim, iFogSim, LibFUSE, Intel PIN, Vivado, Eagle - PCB, .NET, Doxygen, FreeSwitch - SIP Manager, Git, Tensorflow, PyTorch, GEM5, xv6, TKinter, Qt, OpenGL, OpenCV, Arduino, Solidworks, ANSYS, Mininet, Yocto, Ansible, xOpera, TOSCA.

Associated Research Groups

- Quality of Service Research (QORE) Group, Imperial College London. link
- Data Analytics and Intelligence Research (DAIR) Group, IIT Delhi. link
- The Cloud Computing and Distributed Systems (CLOUDS) Laboratory, University of Melbourne. link

Positions of responsibility

- Technical Executive at Makerspace, Design and Innovation Center at IIT Delhi
- Coordinator at Sportech 2017: Sports fest at IIT Delhi

Other Interests

Lawn Tennis, Football, Street Jazz Dance, Graphics Designing, Poster Making, Video Editing, Poetry