Shreya Ghosh PhD Scholar

TCS Research Fellow
Department of Computer Science & Engineering
Indian Institute of Technology Kharagpur
Kharagpur 721302, INDIA
Email: shreya2015@iitkgp.ac.in
Phone: +91 9007448845

Research Interests

Trajectory Pattern Mining, Spatio-Temporal Data Analytics, Cloud Computing, IoT, Machine Learning.

Education

PhD Scholar, Computer Science and Engineering *(August 2016-Present)* Indian Institute of Technology Kharagpur, India Supervisor: Dr. Soumya K. Ghosh, Department of CSE, IIT Kharagpur	*Ongoing*
MS Scholar, School of Information Technology *(June 2015- 2016)* Indian Institute of Technology Kharagpur, India Supervisor: Dr. Soumya K. Ghosh, Department of CSE, IIT Kharagpur [Converted to PhD program in August 2016]	**9.15/10**
B.Tech in Computer Science and Technology *(2011-2015)* Indian Institute of Engineering Science and Technology, Shibpur (IIEST), India [formerly Bengal Engineering and Science University, Shibpur (BESU)]	**8.90/10** (Top 5 in Dept.)
Higher Secondary (XII) *(2009-2011)*, West Bengal Board, India Subjects: Computer Science, Mathematics, Physics, Chemistry, Language Group	**95.25 %** [Best of 4]
Secondary (X) *(2008-2009)*, West Bengal Board, India	**92.60 %** [Best of 5]

Research Contributions

(a) Analysis of large scale GPS traces to explore human movement patterns *(Jun'16 - Apr'20)*,
PhD research work, under the guidance of Prof. Soumya K. Ghosh, CSE, IIT Kharagpur, and with joint collaboration with Prof. Rajkumar Buyya, University of Melbourne

- The work involves extracting knowledge from large scale GPS traces of moving agents namely human mobility data, taxi-cab movements, Call-data-records etc using advanced machine learning techniques. Trajectory data mining has deep implications in various location based and navigation applications. In this work, we aim to analyse mobility data both from semantic and spatio-temporal aspects and come up with novel spatio-temporal clustering methods, classification of mobile-users, transferring knowledge-base from one domain to another domain of interest using multimodal transfer learning etc.

- The work aims to deploy a cloud-fog-edge-IoT based collaborative framework to facilitate applications related to improved health-care, transportation and urban planning. The framework provides several applications in less delay along with less energy consumption.

- Developed an end-to-end prototype having salient features- clustering and categorizing mobile users based on the semantics of their movements, extracting prevalent categorical movement patterns in a given bounding box and transferring mobility knowledge, improved healthcare, namely *Internet of Health Things (IoHT)*, and assisting users in the time of emergency, namely *Mobility-aware Internet of Spatial Things (Mobi-IoST)*.

(b) Spatio-temporal fingerprinting of moving agents using Time Geography *(Mar'17 - June'18)*, PhD research work, under the guidance of Prof. Soumya K. Ghosh, IIT Kharagpur and joint collaboration with Prof. Stephan Winter, University of Melbourne

- Proposing a context-aware framework for computing devices (say a smartphone) that can learn from a users past activity history and provide assistance (or recommendations) in a more contextualized (and personalized) way.

– Developing a trajectory based activity ontology by incorporating virtual and physical space, and time budget.

– Measuring the similarity in activity sequence over weekdays and weekends in temporal domain as well as in spatial domain using fuzzy approach.

(c) Mobility Association Rule Mining from Trajectory Traces to infer Interestingness of Patterns *(Sept'17 - Aug'19)*, PhD research work, under the guidance of Prof. Soumya K. Ghosh

– This work aims to extract meaningful patterns from spatio-temporal data of human movement history (GPS log) and measure the interestingness of the extracted patterns. The analysis provides a mobility based fingerprinting of POIs (point of interest) which in turn allows predicting POI types of a stay-point in an unknown-region. Although, discovering association rules or co-relation patterns from transactional database is a well-known problem, but being able to mine reasonable patterns from movement history (GPS log) is an achievement beyond the state-of-art.

(d) Decision Support System for Transportation of Hazardous Materials in City Region of Kolkata *(Jun'15 - Jul'18)*, JRF, Research Project under MHRD Scheme, SRIC, IIT Kharagpur

– Designed a framework to assist in routing decisions regarding transportation of hazardous materials within Kolkata.

(e)Efficient data analysis and classification in Chemoinformatics *(Feb 2013-Mar 2015)* B.Tech Project under the supervision of Prof. Somnath Pal, IIEST, Shibpur, India

– Developed novel chemical graph mining algorithm for classification of chemical reactions. This work extends Ugi's scheme and capable to classify a wide variety of chemical reactions.

Experience

June'15 - July'18	**Junior Research Fellow** at Department of Computer Science and Engg., IIT Kharagpur.
Jul'16 - Dec'16	**Teaching Assistant** for Programming and Data structure Lab, with 70+ students
Jan'17 - May'17	**Teaching Assistant** for Cloud Computing Course, Course Instructor: Prof. Soumya K. Ghosh
Jul'17 - Dec'17	**Teaching Assistant** for Geographical Information System, Course Instructor: Prof. Soumya K. Ghosh
Jul'17 - Apr'20	**Teaching Assistant** for Online Cloud Computing course, NPTEL (National Programme on Technology Enhanced Learning), Government of India, Instructor: Prof. Soumya K. Ghosh
Jan'20 - Apr'20	**Teaching Assistant** for Google Cloud Computing Foundation Course, NPTEL (National Programme on Technology Enhanced Learning). Instructor: Prof. Soumya K. Ghosh and Google Multi-faculty

Publications

(a) **MARIO: A Spatio-temporal Data Mining Framework on Google Cloud to Explore Mobility Dynamics from Taxi Trajectories**
Shreya Ghosh, Soumya K. Ghosh and Rajkumar Buyya. Journal of Network and Computer Applications (JNCA), ISSN: 1084-8045, Elsevier, Amsterdam, The Netherlands Press. (I.F.:5.57)
https://doi.org/10.1016/j.jnca.2020.102692

(b) **Internet of Health Things (IoHT) for Personalized Health Care using Integrated Edge-Fog-Cloud Network**
Anwesha Mukherjee, *Shreya Ghosh*, Aabhas Behere, Soumya K. Ghosh and Rajkumar Buyya. Journal of Ambient Intelligence and Humanized Computing, ISSN: 1868-5137, Springer Science+Business Media, Berlin, Germany. (I.F.: 4.59)
https://doi.org/10.1007/s12652-020-02113-9

(c) **Exploring Mobility Behaviours of Moving Agents from Trajectory traces in Cloud-Fog-Edge Collaborative Framework**
Shreya Ghosh, and Soumya K. Ghosh. 20th IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGrid 2020) (Doctoral Symposium) [**A rank**]
https://ieeexplore.ieee.org/abstract/document/9139605

(d) **CLAWER: Context-aware Cloud-Fog based Workflow Management Framework for Health Emergency Services,**
Shreya Ghosh, Jaydeep Das, Soumya K. Ghosh and Rajkumar Buyya. Proceedings of the 20th IEEE/ACM International Symposium on Cluster, Cloud, and Internet Computing (CCGrid 2020, IEEE CS Press, USA), Melbourne, Australia, May 11-14, 2020. [**A rank**]
https://ieeexplore.ieee.org/abstract/document/9139714

(e) **LOCATOR: A CLoud-FOg-enabled Framework for Facilitating Efficient LoCATiOn based SeRvices**
Shreya Ghosh, Jaydeep Das, and Soumya K. Ghosh. 12th International Conference on COMmunication Systems & NETworkS (COMSNETS 2020)
https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9027345

(f) **Mobi-IoST: Mobility-aware Cloud-Fog-Edge-IoT Collaborative Framework for Time-Critical Applications**
Shreya Ghosh, Anwesha Mukherjee, Soumya K. Ghosh, and Rajkumar Buyya. IEEE Transactions on Network Science and Engineering (TNSE), 2019 (I.F.: 5.21)
https://ieeexplore.ieee.org/abstract/document/8711428/

(g) **MovCloud: A Cloud-enabled Framework to Analyse Movement Behaviors**
Shreya Ghosh, Soumya K. Ghosh and Rajkumar Buyya. 11th IEEE International Conference on Cloud Computing Technology and Science (CloudCom 2019)
https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8968847

(h) **Traj-Cloud: A Trajectory Cloud for enabling Efficient Mobility Services**
Shreya Ghosh, Soumya K. Ghosh. 11th International Conference on COMmunication Systems & NETworkS (COMSNETS 2019)
https://ieeexplore.ieee.org/abstract/document/8711428/

(i) **Exploring the Association between Mobility Behaviours and Academic Performances of Students: A Context aware Traj-Graph (CTG) Analysis**
Shreya Ghosh, Soumya K. Ghosh. Progress in Artificial Intelligence, Springer Journal, 7(4), pp.307-326, 2018. (I.F.: 3.08)
https://link.springer.com/article/10.1007/s13748-018-0164-6

(j) **Activity-Based Mobility Profiling: A Purely Temporal Modeling Approach,**
Shreya Ghosh, Soumya K. Ghosh, Rahul Deb Das, and Stephan Winter. 27th International World Wide Web Conference (WWW), 23rd - 27th April 2018, Lyon, France. **[A* rank]**
https://dl.acm.org/citation.cfm?id=3186356

(k) **Modeling Individuals Movement Patterns to infer Next Location from Sparse Trajectory Traces,**
Shreya Ghosh, Soumya K. Ghosh. In 2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC), Oct 7-10, 2018, Miyazaki, Japan. **[B rank]**
https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8616122

(l) **Hybrid Path Planner for Efficient Navigation in Urban Road Networks through Analysis of Trajectory Traces**
Sayan Sinha, Mehul Nirala, *Shreya Ghosh*, Soumya K. Ghosh. In Pattern Recognition (ICPR), 2018 25th International Conference on Pattern Recognition, IEEE. **[B rank]**
https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8546101

(m) **Modeling of Human Movement Behavioral Knowledge from GPS Traces for Categorizing Mobile Users**,
Shreya Ghosh, Soumya K. Ghosh. 26th International World Wide Web Conference Companion (WWW), 3rd - 7th April 2017, Perth, Australia. **[A* rank]**
https://dl.acm.org/citation.cfm?id=3054150

(n) **Exploring Human Movement Behaviour based on Mobility Association Rule Mining of Trajectory Traces,**
Shreya Ghosh, Soumya K. Ghosh. 17th International Conference on Intelligent Systems Design and Applications (ISDA 2017), 14-16th December, 2017, Delhi, India.
https://link.springer.com/chapter/10.1007/978-3-319-76348-4_44

(o) **A Machine Learning Approach to Find Optimal Routes analyzing GPS traces of Mobile City Traffic**
Shreya Ghosh, Soumya K. Ghosh and Abhisek Chowdhury. 5th International Conference on Advanced Computing, Networking, and Informatics (ICACNI 2017), 1st-3rd June, 2017, Goa, India.
https://link.springer.com/chapter/10.1007/978-981-10-8636-6_7

(p) **THUMP: Semantic Analysis on Trajectory Traces to Explore Human Movement Patterns**,
Shreya Ghosh, Soumya K. Ghosh. Poster Track, 25th International World Wide Web Conference (WWW), 11th - 15th April 2016, Montreal, Canada. **[A* rank]**
http://dl.acm.org/citation.cfm?id=2893188

Awards and Honors

1. **TCS PhD Research Scholarship** (July 2018 - Present)

2. **IEEE Student Travel Grant** for presenting paper in IEEE International Conference on Systems, Man and Cybernetics (IEEE SMC) 2018

3. **ICPR/IAPR Travel Grant** for presenting paper in International Conference on Pattern Recognition (ICPR) 2018

4. **Microsoft Research Travel Grant** for presenting paper in World Wide Web Conference (WWW) 2017

5. 2nd rank in **Cognizant CIO's Challenge for Students**, Selected in IT foundation of Cognizant Certified Student Program 2015. Developed an web-application titled *"SQL-VAL: Validate your SQL queries without executing!"* to upload and validate SQL query syntax without execution

6. 3rd rank, **Demo competition in IBM Day 2016**, IIT Kharagpur, 24th September, 2016. Title: *"Mobility Summary and User Categorization based on Semantic Analysis of Human Movement Patterns" Shreya Ghosh*, Manasa JM, Abhisek Chowdhury

7. **Government Merit Scholarship for Graduate Study**, Outstanding performance in Higher Secondary Examination 2011

Skills

Programming	Proficient in C, Python, R
Database and GIS	PostgreSQL, Oracle Spatial 11g, QGIS
Platform and Tools	Google Cloud Platform (GCP), MatSim, SUMO, Enterprise Architect, LaTeX

Workshops Organized

1. **Resource person** in the training workshop *"Geospatial Data Modeling from Spatial Data to Spatial Web Services"* (23-25 June 2015, and 9-11 March 2016) jointly organized by IIT Kharagpur and DST, India.

2. **Resource person** in the training workshop "Geospatial Data Modeling from Spatial Data to Spatial Web Services" (23-25 June 2015, and 9-11 March 2016) jointly organized by IIT Kharagpur and DST, India. Delivered lectures and demonstrations to the participants.

3. **Resource person** in the training workshop *"Geospatial Data Modeling and Mobile Apps for GI Application"* (6-8 July 2016) jointly organized by IIT Kharagpur and DST, India. Delivered lectures and demonstrations to the participants.

4. **Resource person** in the *"DST symposium on National Geospatial Science and Technology Development"* (27 Jan 2017) [Kolkata Campus]. Delivered lectures and demonstrations to the participants.

5. **Resource person** in the training workshop *"Geospatial Data Modeling and Geospatial Cloud for SDI"* (22-24 Aug 2017) jointly organized by IIT Kharagpur and DST, India. Delivered lectures and demonstrations to the participants.

6. **Resource person** in the training workshop *"Geospatial Cloud: Enabling Data and Application Services"* (16 - 18 May 2018) jointly organized by IIT Kharagpur and DST, India. Delivered lectures and demonstrations to the participants.

7. **Speaker** in the workshop *"Coordinated Preparation of High Resolution National Foundation Spatial Data (NFSD) for Gram-Panchayat and Ward Level Mapping"* (18 - 22 Dec 2018) jointly organized by DST, Govt. of India and Odisha Space Application Center (ORSAC).

8. **Speaker** in the workshop *"Use of geospatial cloud-based platform for development of data services and registers"* (10 - 11 Dec 2019) jointly organized by Indian Institute of Surveying Mapping (IISM), Hyderabad, India and DST

References

[1] Dr. Soumya K Ghosh [PhD Supervisor]
     Professor, Department of Computer Science and Engineering
     National Geospatial Chair Professor (DST, India)
     Indian Institute of Technology, Kharagpur
     Email: skg@cse.iitkgp.ac.in

[2] Dr. Rajkumar Buyya
     Redmond Barry Distinguished Professor
     Director, CLOUDS Lab
     Department of Computer Science Engineering
     The University of Melbourne, Australia
     Email: rbuyya@unimelb.edu.au