Abira Sengupta

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Summary: My PhD thesis on multi-agent systems to represent reasoning with explicit representation of expectation can solve the collective action problem was recently submitted under the supervision of Professor Stephen Cranefield (University of Otago, New Zealand) and Professor Jeremy Pitt (Imperial College, London). I worked as a research assistant in the computer science department at Otago University in 2021. I am a member of the Centre for Artificial Intelligence and Public Policy (CAIPP) at Otago since I am passionate about fair and transparent AI. I am also an IEEE member. Previously, I worked on my pre-PhD research at the Indian Statistical Institute in collaboration with the University of Technology, Sydney.

🎓 EDUCATIONAL QUALIFICATIONS

- **Doctor of Philosophy (PhD) in Information Science (📅 2019 - 2022, graduate in 2023)**
  University of Otago, New Zealand.
  - **Supervisor: Prof. Stephen Cranefield**
  - **Co-supervisor: Prof. Jeremy Pitt**
- **Master of Technology (M.Tech) in Computer Science (📅 2011 - 2013)**
  West Bengal University of Technology, India. (GPA: 8.87/10)
- **Bachelor of Technology (B.Tech) in Computer Science (📅 2006 - 2010)**
  West Bengal University of Technology, India. (GPA: 7.43/10)
- **Math Honours**
  I completed two years of a three-year honour course before switching to BTech.

💻 RESEARCH EXPERIENCE (🤖 Multi-Agent Systems, Artificial Intelligence, Planning)

- **PhD Research at the Information Science Dept, Univ. of Otago, NZ (Submitted)**
  - **Thesis Title: A generic approach to reasoning about collective action problems using expectations.**
  - **Funding: PhD funded by Marsden Fund, in collaboration with Imperial College.**
  - **Research paper accepted in COINE 2021 and COINE 2023, and another paper from the bursary period wanted to submit to the Journal of Artificial Intelligence Research.**

  Thesis Summary: My work focuses on the use of logical reasoning regarding expectations and generalised representation to help computational agents to solve a range of collective action problems. The different applications of expectation-related reasoning, such as expectation, team reasoning norms, norm, and norm emergence from emotion, were explained in this work. The central claim of my research is to build a generalised computational model in which symbolic representations of norms are used as an input and an Event Calculus (Prolog-based) is used to represent how explicit reasoning of expectation is generated and how it is fulfilled or violated.

- **Post-PhD Research (📅 2023)**

  - **To investigate how emotions aid in the retrieval of normative reasoning in a multi-agent system.**
  - **Working as a data analyst on a Telehealth project.**

- **Research Assistant at the Computer Science Dept, Univ. of Otago, NZ (📅 2021)**

  - **A short project on the computational analysis of text data for emotion recognition.**

- **Research collaboration at the Information Science Dept, Univ. of Otago, NZ.**

  - **Prediction of Wildfire Susceptibility Using Machine Learning Approach.**

  Project: We focused on developing wildfire prediction models using Support Vector Machine, Isolation Forest, AutoEncoder, and Variational AutoEncoder to delve deeper into this problem. To avoid bias in selecting training and testing data sets, outcomes were validated using five-fold cross-validation. These models achieved high mean accuracy ranging from 98 to 99 percent. In addition, the best-performing models are operationalized by deploying the ML models as a REST API using Python Flask via a Web-based tool.

- **A Preliminary Investigation of LEACH, TEEN and DEEC Towards Wireless Sensing Application (Extention of MTech Thesis)**

  Project: In wireless sensor networks, the nodes operating in a distributed environment operate on a limited source of energy and rely on efficient power optimisation protocols to operate for the appropriate duration of their wireless data-sensing applications. In this paper, we present a comparative analysis of three prominent hierarchical clustering protocols: LEACH, TEEN, and DEEC.

- **Pre-doctoral Research at the Indian Statistical Institute (📅 2017 - 2018)**

  - **Research: Machine Learning applied to facial image and pin-code detection.**
  - **3 papers were published in collaboration with Univ. of Technology, Sydney and the Indian Statistical Institute (ISI).**

  Project: During my pre-PhD research, I collaborated with the ISI CVPR department under the supervision of Dr. Umapada Pal. Convolutional neural networks were used to detect the pin-code in both structural and unstructured postal documents, as well as to authenticate facial images. CNN has been found to be effective at identifying individuals from degraded face images.

+ RESEARCH SUPERVISION:

  - **In collaboration with the Indian Statistical Institute, I started mentoring a PhD student. The study focuses on the use of Machine Learning methodologies for wildfire prediction.**

  - **Co-supervised the final year thesis of one Master of Information Science student at Kalyani Government Engineering College in 2020-2021. In that project, we**

classified various types of road obstacles using a **convolutional neural network. We also used the YOLO algorithm to classify and locate various types of objects in front of the car.**
- **Research project supervision for four Bachelor students of Computer Science at Narula Institute of Technology in 2017-2018.**

📚 TEACHING EXPERIENCE

- **Tutor/Demonstrator at the University of Otago, NZ (📅 2019 - 2023: 7 semesters)**

  - **2023: Digital Health, DIGH 708 & 709, Review innovations in Digital Health technology that promote well-being and self-management.**
  - **2023, 2022, 2021: COMP 120, Data Science using R.**
  - **2023, 2022, 2021, 2020: INFO 204, Machine learning using Python coding.**
  - **2022: INFO 301, Software development.**
  - **2021: INFO 310, Software and system development using JAVA.**
  - **2019: COMP 101, R and SQL coding.**
- **Guest Lecturer (part-time) at several universities in Kolkata, India (📅 2013 - 2018)**

  - **Jadavpur University - Taught multimedia systems.**
  - **Kalyani Govt Engg College - Taught Algorithms, Automata, Graphics, and Multimedia.**
  - **Aliah University - Taught Sensor Networking theory.**
  - **Narula Institute of Technology - Taught C, Multimedia, Networking theory.**

+ PROFESSIONAL PORTFOLIO

- **RESEARCH FUNDING/GRANTS**
  - **57250 NZD: Marsden scholarship (3 years PhD studies).**
  - **2964 NZD: Pūtea Tautoko - Student Relief Fund.**
  - **2800 NZD: Departmental award.**
  - **3500 NZD: Technical Education Quality Improvement Programme**
- **MEMBERSHIP**
  - **Member of the Centre for Artificial Intelligence and Public Policy (CAIPP), NZ.**
  - **Member of the Artificial Intelligence Researchers Association (AIRA), NZ.**
  - **Student member of IEEE.**
- **PEER REVIEW**
  - **Conferences: SMC-2023**
- **WORKSHOP ORGANIZING COMMITTEE**
  - **School of Computing Postgraduate Symposium 2023, University of Otago.**
- **AWARDS/FUNDS**
  - **Commerce Research Grant Round 2-2023.**

✍️ REFERENCES

- **DR. STEPHEN CRANEFIELD (Relation: Primary supervisor)**
  - **Affiliation: Professor, School of Computing, University of Otago, NZ.**
  - **Email: stephen.cranefield@otago.ac.nz, Phone: +64 3 479 8083.**

- **DR. SHERLOCK LICORISH (relation: Tutored for him and Collaborated on one paper.)**
    - **Affiliation: Associate Professor, School of Computing, University of Otago, NZ.**
    - **Email: sherlock.licorish@otago.ac.nz, Phone: +64 3 479 8319.**

- **DR. BRENDON WOODFORD (relation: Tutored for him and Collaborated on one paper.)**
    - **Affiliation: Lecturer, School of Computing,University of Otago, NZ.**
    - **Email: brendon.woodford@otago.ac.nz, Phone: +64 3 479 5432.**

- **DR. GRANT DICK (relation: Tutor for him)**
    - **Affiliation: Head of Department (HOD), University of Otago, NZ,**
    - **Email: grant.dick@otago.ac.nz, Phone: +64 3 479 8180.**

📄 CONFERENCE PUBLICATIONS

- **Abira Sengupta, Stephen Cranefield, Jeremy Pitt, "Generalising Axelrod's Metanorms Game through the use of explicit domain-specific norms", (COINE) 2023. [Accepted]**
- **Fathima Nuzla Ismail, Abira Sengupta, Brendon J. Woodford, Sherlock A. Licorish, "A Comparison of One-class versus Two-class Machine Learning Models for Wildfire Prediction in California", (AUSDM) 2023. [Accepted]**
- **Abira Sengupta, Stephen Cranefield, Jeremy Pitt, "Solving social dilemmas by reasoning about expectations", (COINE) 2021: 1-18. DOI:** https://doi.org/10.1007/978-3-031-16617-4_10
- **Abira Sengupta, Saurabh Malgaonkar, Nikita Mehrotra, Tejas Hirave, "A Preliminary Investigation of LEACH, TEEN and DEEC Towards Wireless Sensing Application", (ICCICT) 2021: 1-6.** DOI: 10.1109/ICCICT50803.2021.9510108
- **Abhijit Das, Abira Sengupta, Muhammad Saqib, Umapada Pal, Michael Blumenstein, "More Realistic and Efficient Face-Based Mobile Authentication using CNNs", (IJCNN) 2018:1-8.** DOI: 10.1109/IJCNN.2018.8489070
- **Abhijit Das, Abira Sengupta, Miguel A. Ferrer, Umapada Pal, Michael Blumenstein, "Linking face images captured from the optical phenomenon in the wild for forensic science", (IJCB) 2017: 781-786.** DOI: 10.1109/BTAS.2017.8272770, Citations-2
- **Nabin Sharma, Abira Sengupta, Rabi Sharma, Umapada Pal, Michael Blumenstein, "Pincode detection using deep CNN for postal automation", (IVCNZ) 2017: 1-6.** DOI: 10.1109/IVCNZ.2017.8402501, Citations-13.

📄 POSTER PRESENTATION

- **Abira Sengupta, Stephen Cranefield, "Normative Reasoning Based On Emotions In Multi-Agent System To Solve Social Dilemmas", (Student Research Symposium of Otago) 2021.**
- **Abira Sengupta, Stephen Cranefield, Jeremy Pitt "Generalising Axelrod's metanorm game with the expectation event calculus", (Artificial Intelligence Researchers Association (AIRA), NZ). https://www.ainz.ai/2022-posters**