





## Minal Suresh Patil

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CONTACT INFORMATION	Mit-huset Dept. of Computer Science Umeå Universitet Umeå, 901 87 Sweden	Voice: (+46) 0738192248 Fax: 090-786 61 26 E-mail: <a href="mailto:minalsp@cs.umu.se">minalsp@cs.umu.se</a> WWW: <a href="https://minalspatil.github.io">https://minalspatil.github.io</a>
RESEARCH INTERESTS	My research interests lie at the intersection between formal methods, verification and software engineering, particularly in applying formal methods to ensure provable reliability guarantees to AI-enabled software systems.	
KEYWORDS	Safe and Trustworthy AI, Formal Methods, Verification, Cyber-Physical Systems	
EDUCATION	<b>Umeå Universitet</b> , Umeå, Sweden Ph.D. Candidate <i>Wallenberg AI, Autonomous Systems and Software Program</i> <ul style="list-style-type: none"><li>• Topic: On the Role Formal Methods for Safe AI</li><li>• Advisor: <a href="#">Kary Främling</a></li></ul> <b>University College London</b> , London, United Kingdom MSc., Data Science and Visualisation <ul style="list-style-type: none"><li>• Dissertation - <i>Can we understand how demographics, product usage, revenue and product movements affect customers up-sell and cross-sell journey in the telecommunications sector?</i> </li><li>• Advisor: <a href="#">Kira Kempinska</a></li></ul> <b>R.V. College of Engineering</b> , Bengaluru, India B.E., Computer Science <ul style="list-style-type: none"><li>• Dissertation Topic - Fuzzy Graph Clustering for Image Segmentation</li></ul>	<b>Oct. 2020 - Oct. 2024</b>     <b>Sept. 2018 - Sept. 2019</b>     <b>Sept. 2011 - Sept. 2015</b>
PUBLICATIONS	<b>M.S. Patil and Kary Främling. Improving Neural Network Verification Efficiency through Perturbation Refinement.</b> <i>In Proceedings of 32<sup>nd</sup> International Conference on Artificial Neural Networks (ICANN), 2023.</i>  <b>M.S. Patil and Kary Främling. Do Intermediate Feature Coalitions Aid in the Explainability of Black-Box Models?.</b> <i>In Proceedings of 1<sup>st</sup> World Conference on eXplainable Artificial Intelligence, 2023</i>  <b>M.S. Patil. Towards Preserving Semantics Structure in Argumentative Multi-Agent via Abstract Interpretation.</b> <i>In Proceedings of 3<sup>rd</sup> Online Handbook of Argumentation for AI (OHAAI), 2022</i>   <b>M.S. Patil. Modelling Control Arguments via Cooperation Logic in Unforeseen Scenarios.</b> <i>In Proceedings of Thinking Fast and Slow and Other Cognitive Theories in AI of Fall Symposium Series at 36<sup>th</sup> Association for the Advancement of Artificial Intelligence (AAAI), 2022</i>   <b>M.S. Patil. Explainability in Autonomous Pedagogically Structured Scenarios.</b> <i>In Proceedings of Workshop on Explainable Agency in Artificial Intelligence at 36<sup>th</sup> Association for the Advancement of Artificial Intelligence (AAAI), 2022</i>   <b>M.S. Patil. Towards Explainable Agency in Multi-Agents Systems Using Inductive Learning and Answer Set Programming.</b> <i>In 6<sup>th</sup> International Conference on Automation, Control and Robotics</i>	

*Engineering (IEEE-CACRE), 2021 (oral presentation)*

PAPERS IN  
PREPARATION

**M.S. Patil and Kary Främling. Proving Safety in Deep Neural Networks: Leveraging Intermediate Properties for High-Level Guarantees.** *In Submission to 3<sup>rd</sup> ERCIM Working Group conference on Formal Methods for Industrial Critical Systems (FMICS), 2023*

**M.S. Patil and Kary Främling. Verification of Coalition Announcement Logic via Model Checking.**

**M.S. Patil and Kary Främling. Formalisation of Multi-agent disagreement through SMT and Coq.**

Kary Främling, M. Madhikermi, M. Westberg, S. Anjomshoae, N. Fouladgar, **M.S. Patil**, A. Zelvelde, A. Malhi & S. Knapič. **Explainability, AI and Why Humans Need Context-Specific Explanations in Real-Life Situations.**

PATENTS

- Patil, M.S. 2019. *Method and System for Geo-Psychographic Segmentation Using Location Data and Learning models.* Indian Patent 201841034549, filed September 11, 2018.

PROFESSIONAL  
EXPERIENCE

**Virgin Media**, London, United Kingdom

*Research Intern*

**Oct. 2018 - Sept. 2019**

- Developed a halo-forecasting model for customer up-selling opportunities, leveraging a blend of location data, transaction histories, and customer profiles, resulting in an accuracy of 83.4%.
- Implemented advanced ensemble methods, including Random Forest and Gradient Boosting, to improve the predictive performance of the model.
- Analysed and processed a large-scale dataset of 70,852 customers and over one million transactions, extracting actionable insights for targeted up-selling strategies, resulting in a 15% increase in customer conversion rates.

**Propinquity Labs**, Bengaluru, India

*Geospatial Data Scientist*

**June 2016 - Sept. 2018**

- Led and managed a high-performing team of deep learning geospatial scientists and engineers to develop cutting-edge solutions for geospatial data analysis and interpretation.
- Spearheaded the implementation of a spectral land-use change detection model for environmental monitoring in satellite imagery, improving precision by 20% and reducing false positive rates by 30%.
- Conducted a comprehensive evaluation of different deep learning architectures and performance metrics for geospatial image analysis, optimizing model selection based on accuracy, precision, and computational efficiency.

**Sensus Labs**, San Francisco, California, United States

*Navigation Guidance Engineer*

**May 2015 - June 2016**

- Developed filter-based navigation algorithms (Kalman Filters and other linear and non-linear filters) to fuse information from a variety of sensors (IMU, GPS, magnetometer, static/differential pressure, cameras, etc.) reducing position error by 30% compared to traditional sensor fusion techniques.

- Conducted a comparative analysis of different Kalman filter variants for warehouse logistics tracking system in GPS-denied environments, optimising performance metrics such as mean squared error (MSE) and root mean squared error (RMSE).
- Collaborated with a team of engineers to develop a real-time navigation guidance system for autonomous systems, achieving sub-centimeter accuracy in various navigation scenarios.

#### SERVICES

EXTRAAMAS 2023 (Reviewer), ICANN 2023 (PC-member)

#### COMPUTER SKILLS

- Languages: C++, Python, OCaml, Rust, SQL
- Verification Tools: Lean and Coq (proof assistants), TLA+ model checker, Frama-C, Dafny
- Frameworks: PyTorch, TensorFlow
- Tools and Technologies: Docker, Kubernetes
- Operating Systems: Unix/Linux