Neha Priyadarshini Garg, Ph.D.

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Singapore Permanent Resident, Indian national

Research Interests

- Integrating foundational models (LLMs, vision-language models) with planning
- Human Robot Interaction
- Artificial intelligence for robotics

Professional Experience

Rehabilitation Research Institute of Singapore, NTU **Jul 2020-current**
Research Fellow / Project Lead (with Prof. Wei Tech Ang and Prof. Tat Jen Cham)
Leading team of researchers for multiple projects

- Ideation and execution of various research projects
- Leading discussions with stakeholders like Society for Physically Disabled (SPD), old age/ nursing homes, cerebral palsy subjects and occupational therapists to identify real world problems
- Technical presentations and demonstrations to funding agencies (NRP), industry partners, external showcase events (NRP Festival, Rehab Week)
- Successfully achieved all KPIs for the first grant from National Robotics Program (NRP) for robotic wheelchair
- Prepared roadmap and technical proposal submission for the second grant leading to 1.5 years' funding
- Mentoring PhD and final year bachelor students

Key Projects
Integrating foundational models with planning

- Explainable trajectory corrections from language inputs using textual description of features and LLMs for robot arm Video
- Training of human motion foundational model from Asian MOCAP dataset using masked trajectory model and its use in motion style imitation through knowledge distillation

Human robot interaction

- Shared Autonomy of a Robotic Manipulator for Grasping under Human Intent Uncertainty using Partially Observable Markov Decision Process (POMDPs) (Video)
- Intention prediction based shared control of robotic wheelchair amongst static and dynamic obstacles. Using this core idea for robust joystick control by people with disability (Video), following of caregiver walking by side of wheelchair and remote teleoperation of wheelchair
- A system for autonomous table docking with a point and click interface Video

Artificial Intelligence for robotics

- Learning-based Motion-Intention Prediction from IMU, EMG and MMG sensors for End-Point Control of Upper-Limb-Assistive Robots
- Using style and content disentanglement to learn few-shot human joystick input model for automating testing of shared control algorithms in simulation
- Scooping exact amount of food based on vision and force torque sensor feedback using dynamic motion primitives

Professional Experience (continued)

School of Computing, National University of Singapore **Aug 2013 - Jun. 2020**
PhD (with Prof. David Hsu and Prof. Wee Sun Lee)
Title : Autonomous Grasping Under Uncertainty Using POMDPs

- Demonstrated robust grasping of large variety of objects using binary touch and vision feedback by modelling the problem as a partially observable Markov decision process (POMDP) and learning a fast LSTM based policy from pomdp policy Video
- Developed a new generic online POMDP solver DESPOT-α which can deal with large observation spaces
- Used this new solver to grasp objects under uncertainty using full image feedback

Affle, Singapore, a mobile media company **Aug 2011 – Jan 2013**
Senior Software Engineer
Server-side development for mobile and web applications using Java Spring framework

- Development of ad server and management of Ad Operations leading to successful launch of Affle's ad server Ripple
  - Developed GUI using Java Spring framework for creating rich media html / javascript ads without html / javascript knowledge
  - Trained junior team members about digital ad serving operations
- Added friend recommendation feature for automatic help bot for Affle's mobile messenger app
- Developed Push Notification Server and Authentication Server which helped reduce time required to create new mobile apps

Kooaba, Zurich, an image recognition startup acquired by Qualcomm **Dec 2008 – Feb. 2011**
Software Engineer
Research and development of image recognition platform

- Grew the image database from few hundred images to 20 million images in 6 months for launch of Kooaba Image Recognition API by writing software for gathering images and meta-data from sources like Amazon, Google, various magazines and newspapers and specific client sources.
- Designed and implemented the module for automatically indexing new images from client and deploying the index in the live image recognition servers on Amazon EC2 using which various newspapers and magazines could easily go live in the Kooaba system in a few hours. This was essential for success of Kooaba-Paperboy app that linked newspaper images to additional content
- Experimented with different technologies for improved recognition of images containing text

IBM Research, Zurich **Feb. 2008 – Sep. 2008**
Master Thesis (with Andre Elisseff and Ulf H Neilsen at IBM Zurich Research)
Title: Model user navigation and summarization of information on 3D human model

- Mapping and then summarizing anatomical concepts in medical ontologies (FMA, SNOMED) on 3D model of human for navigating through it
- The startup Nhumi Technologies (www.nhumi.com) later used this research for its products

ICSI, Berkeley **Sep 2007 – Feb. 2008**
Research Visitor (with Dr. Dilek Hakkani-Tur)
Title : Speaker role detection using social network and lexical features

- Trained Adaboost model for speaker role classification from meeting text based on interaction patterns among people and the spoken text

Education

Aug 2013 – Jun 2020 **Ph.D.**, *School of Computing at National University of Singapore in Arificial Intelligence and Robotics (GPA 4.75/5)*

Oct 2006 – Sep 2008 **Masters**, *Ecole Polytechniue Federal de Lausanne (EPFL), Switzerland in Computer Science (GPA 5.5/6)*

Jul 2002 – May 2006 **B.Tech**, *Indian Institute of Technology (IIT), Delhi, India in Computer Science and Engineering (GPA 8.1/10)*

Patents and Publications

Patents

1. Ang, W. T., Leong, M. K. I., **Garg**, **N. P.**, Pang, W. C., & Lei, L. (2023). An autonomous table docking system for robotic wheelchair [WO 2023/200398 A2].
2. Ang, W. T., **Garg**, **N. P.**, Lei, Z., Tan, B. Y., Li, L., & Sidarta, A. (2022). A shared control system for goal directed navigation of wheelchair [WO/2022/216232 A1].
   https://www.sumobrain.com/patents/WO2022216232A1.html

Publications

1. Yang, S., **Garg**, **N. P.**, Gao, R., Yuan, M., Noronha, B., Ang, W. T., & Accoto, D. (2023). Learning-based motion-intention prediction for end-point control of upper-limb-assistive robots. *Sensors*, *23*(6).
   https://doi.org/10.3390/s23062998
2. Yow, J.-A., **Garg**, **N. P.**, & Ang, W. T. (2023). Shared autonomy of a robotic manipulator for grasping under human intent uncertainty using pomdps. *IEEE Transactions on Robotics*, 1–19.
   https://doi.org/10.1109/TRO.2023.3334631
3. Lei, Z., Tan, B. Y., **Garg**, **N. P.**, Li, L., Sidarta, A., & Ang, W. T. (2022). An intention prediction based shared control system for point-to-point navigation of a robotic wheelchair. *IEEE Robotics and Automation Letters*, *7*(4), 8893–8900. https://doi.org/10.1109/LRA.2022.3189151
4. **Garg**, **N. P.**, Hsu, D., & Lee, W. S. (2019a). Despot-alpha: Online pomdp planning with large state and observation spaces. *Robotics Science and Systems (RSS)*.
   https://doi.org/10.15607/RSS.2019.XV.006
5. **Garg**, **N. P.**, Hsu, D., & Lee, W. S. (2019b). Learning to grasp under uncertainty using pomdps. *International Conference on Robotics and Automation (ICRA)*, 2751–2757.
   https://doi.org/10.1109/ICRA.2019.8793818
6. **Garg**, **N. P.**, Favre, S., Salamin, H., Tür, D. H., & Vinciarelli, A. (2008). Role recognition for meeting participants: An approach based on lexical information and social network analysis. *Proceedings of the 16th ACM International Conference on Multimedia (ACM-MM)*, 693–696.
   https://doi.org/10.1145/1459359.1459462

Under Review

1. **Garg**, **N. P.**, Leong, M., Ramanathan, M., Pang, W.-C., Li, L., & Ang, W. T. (2023). *A system for docking robotic wheelchair to partially visible table of unknown pose using human input and robotic wheelchair motion* [Elsevier Robotics and Autonomous Systems].
2. Yow, J.-A., **Garg**, **N. P.**, Ramanathan, M., & Ang, W. T. (2023). *Extract - explainable trajectory corrections from language inputs using textual description of feature* [Frontiers in Robotics and AI].

Peer Review

- International Conference on Robotics and Automation (ICRA)
- International Conference on Intelligent Robots and Systems, (IROS)
- IEEE Robot and Automation Letters (RAL)
- IEEE Transanction on Robotics (T-RO)

Mentoring

- [PhD]Mr. Lei Zhen on intention prediction based shared control of robotic wheelchair. He is submitting his thesis in Dec 2023.
- [PhD] Mr. Sibo Yang on learning based method for motion intention prediction. He passed his QE in 2022.
- [PhD] Ms J-Anne Yow on personalizing robot behaviour in assistive feeding through natural language communication. She passed her QE in 2023.
- [PhD] Ms Qi Qinyi on intention prediction based shared control of robotic wheelchair amongst dynamic obstacles. She will attempt QE in 2024.
- 13 NTU students (over 3+ years) for their Final Year Projects (FYP) on topics related to imitation learning, reinforcement learning, grasping and manipulation, navigation in large and crowded environments, assistive feeding. All the students received either A or A+.

Skills

Languages	Python, C++, Java, Ruby on Rails, Perl, UNIX Shell Script
Databases	MySQL, MongoDB
Platforms	Linux, Windows
Miscellaneous	ROS, MoveIt!, Vrep, Tensorflow, Keras, PyTorch

Awards and Achievements

- Fourth in Amazon Picking Challenge (2015)
- Received scholarship for PhD from National University of Singapore ISEP program (2013)
- Received scholarship from IDIAP for research fellowship at ICSI, Berkeley (2007)
- Secured All India Rank 40 (Top 0.02%) amongst more than 200 thousand students in the Entrance Examination for admission to IITs (2002)
- Got 3rd position in Regional Mathematics Olympiad in north-west India (2001)
- Selected in top 1% students from India for International Physics and Chemistry Olympiad (2001)
- Topped Haryana State of India and was awarded National Talent Search Examination scholarship for full formal education period in India (2000)

References

Available on Request