An industrial perspective on AI needs for Multimodal HRI

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Abstract

Never before in the history of robotics, robots have been so close to us, in our society. We are 'evolving', so as our society, lifestyle and the needs. AI has been with us for decades, and now embodied in robots, penetrating more in our day-to-day life. All these are converging towards creating a smarter ecosystem of living, where social robots will coexist with us in harmony, for a smarter, healthier, safer and happier life. Such robots are supposed to be socially intelligent and behave in socially expected and accepted manners. The talk will reinforce that social robots have a range of potential societal applications and hence impacting the education needs and job opportunities as well. The talk will begin with illustrating some of the social robots and highlight what does it mean to develop a socially intelligent robot, and the associated R&D challenges. This will be followed by some use cases, end user feedback and the market analysis. The talk will conclude with some open challenges ahead, including social and ethical issues and emphasize on the greater need of a bigger and multi-disciplinary effort and eco-system of different stakeholders including policy makers.

1 Talk's summary

The Multimodality of interaction is the key for social robots to be a successful product. Multimodality can be wide ranging including verbal, non-verbal (gesture, micro motions, eye blinking, movement, sound, etc.) as well as physical interaction. Further, such multimodality has to be supporting learning through HRI and enabling the robot to be proactive. This will lead towards successful natural human robot interaction for long-term, beyond the effect of novelty. In addition the need of being socially intelligent adds the dimension of generating high-level interaction behaviours, which includes being active listener as well and incorporate the notions of turn giving and taking, perspective taking, etc. And all these should be harmonized with situated dialog instantiation by the robot. Hence, there is a great need of investigation at the cross section of AI, Robotics and Psychology, to come up with a coherent functional and theoretical framework for Socially Intelligent Human Robot Interaction.

From industrial perspective there are additional constraints, such as robust perception in the real environment, perceiving and acting in the real time with available resources. In this regard, connectivity, learning and cloud based collective intelligence, including IoT might be very helpful. HRI without the capability of dynamically interacting with different kinds of real users is not impactful. This includes even considering the cultural and individual preferences of the users. Towards this end various efforts are ongoing, for example, the EU-JP project CARESSES is exploring in the direction of culturally-aware robot and connected devices [6]. EU H2020 project MuMMER is exploring the multimodality of interaction and perception from putting a robot in a real environment of shopping mall [1]. Other EU H2020 projects, CROWDBOT, among other aspects, aims to develop physical HRI modality for navigating and guiding visually impaired, elderly and disabled people in a crowded environment. Whereas EU H2020 ITN ANIMATAS , aim to explore the multimodality for the social-interactive-robots(agents)-in-the-loop based education. Two other projects L2ToR and DREAM are exploring the interaction modalities of a social robot respectively for teaching second language to children and for autism therapy. Through such projects the robot, its capabilities and the uses potentials are evolving even for different domains, e.g. using the robot for narrative memory based human-robot companionship [7].

From AI perspective, such needs and use cases all together poses the challenge of developing a coherent scientific and functional framework, in order to develop the social intelligence and proactive behavior of the robots [5], [2], and to understand the human-robot engagement [3]. Another need is to provide the users with some natural and intuitive means to program or teach new behaviors to the robot, so that the robot can be more useful in different domains and personalized [4]. Some of the other aspects, which might be surfacing as the greater concerns in the future, include Privacy vs. Owner's command vs. Social Accountability and Ethics, [8], for which involvement of a larger multidisciplinary community is much needed..

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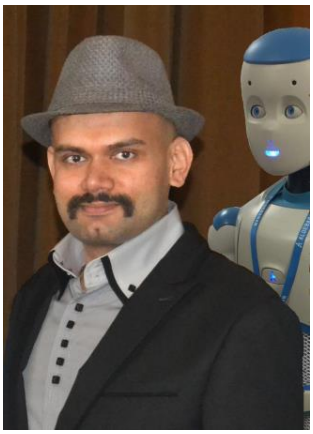

Short Bio: Dr. Amit Kumar Pandey is Head Principal Scientist (Chief Scientist) at SoftBank Robotics Europe (formerly Aldebaran Robotics), Paris, France. Earlier for 6 years he was a researcher in Robotics and AI at LAAS-CNRS (French National Center for Scientific Research), Toulouse, France. His PhD work on "Towards Socially Intelligent Robots in Human Centered Environment", is awarded among the best three Ph.D. Theses in Robotics in Europe for the prestigious Georges Giralt Award. He is also the founding coordinator of Socially Intelligent Robots and Societal Applications (SIRo-SA) Topic Group (TG) of euRobotics, and a contributor in its Multi-Annual Roadmap (MAR), which aims to shape the future of robotics in Europe in collaboration with European Commission (EC) through PPP SPARC (one of the largest civilian-funded robotics innovation program in the world).

His research interest includes Socially Intelligent Robots and Societal Impact of robotics & AI technologies, Human Robot Interaction, Robot's Cognitive Architecture & Learning. On these aspects, he has been actively contributing as principal investigator, researcher and industrial scientific coordinator in various national and European Union (EU) projects, published more than 50 scientific research papers and delivered more than 70 invited talks/keynotes/lecture in international venues. He is also the recipient of Pravashi Bihari Samman Puruskar 2014 (Non Residential Bihari Honour Award), for Science, Technology and Education, one of the highest level civilian honors, awarded by the state of Bihar, India.

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