EXCLUSIVE - How technological innovation at NTU's LILY is helping pave the way towards an ageless society in Singapore

LILY's interdisciplinary research aims to address the physical, social, cognitive, emotional, and sustainability challenges related to aging.
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By Priyankar Bhunia

Above photo: LILY Director Prof. Miao Chun Yan Delivers Speech at the Conference for Big Data And AI in Medical & Fin Tech On 13 Apr 2017/ Credit: NTU

Singapore is faced with a rapidly ageing population today. A quick glance at Singapore's age pyramid since 2000 shows the rate of the demographic shift. As Singapore deals with the multi-faceted challenges arising from this shift in demographics, technology would be an essential part of the toolbox.

The Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly (LILY) at Nanyang Technological University (NTU) focuses on the design of computing technologies that help the elderly enjoy an active and independent lifestyle.

The Centre, set up in August 2012, with support from the Interactive Digital Media Programme Office (IDMPO), National Research Foundation (NRF), NTU and The University of British Columbia (UBC), aims to be one of the world's first incubators of inter-disciplinary research ideas to promote an active and independent lifestyle for the elderly, and to establish Singapore as a hub in designing and building technology enabled age-friendly communities.

For instance, 'silver games' are being developed at LILY for physical and cognitive exercises. These games can incorporate long term real-time analysis of user performance in silver games for preventive intervention and can be personalised to suit the therapeutic and needs of elderly individuals with different physical and cognitive conditions.

Above photo: LILY at Silver IT Fest on 10-11 June 2017/ Credit: NTU

Another area of research is 'silver extension', which seeks to develop innovative smart home designs which adopt appropriate technologies to meet the elderly residents' higher level socio-emotional needs such as companionship and socialization.

Another project is 'silver assistant' for the design and development of a personalised artificial companion to help reduce the problem of loneliness among the elderly. The silver agent can reside in multiple devices and platforms for easy access by the elderly, and provide them with a wide range of companionship features.

OpenGov spoke to Professor Miao Chun Yan from the School of Computer Science and Engineering, College of Engineering at NTU and Founding Director at LILY to learn more about the cutting-edge research happening at LILY. For the past two decades, Prof. Miao has worked on new disruptive Artificial intelligence (AI) approaches and theories that synergise human intelligence, artificial intelligence and behavior data analytics (AI powered by humans).

Given the context of a fast-aging population in Singapore, what are the problem statements the research at NTU's LILY is trying to address? What are the disciplines and technologies involved?

Around the world, population is aging rapidly due to increasing lifespans and decreasing birth rates. By 2030, 34 major countries around the world (including USA, UK, Japan, Germany, Canada, and Singapore) will become "Super Aged", meaning that over 20% of their population will be aged 65 years or older. This presents unprecedented and serious social and economic challenges to society, but also offers new opportunities for forward-thinking nations to capture. Technology has a key role to play in overcoming the challenges and harnessing the opportunities brought about by this rapid demographic change.

LILY's vision is to help pave the way to an ageless aging society in Singapore through researching and developing novel technologies that

1) help society gain a deeper understanding of the elderly population's needs and preferences, and 2) empower senior citizens to lead an active, independent and dignified lifestyle.

LILY's interdisciplinary research aims to address the physical, social, cognitive, emotional, and sustainability challenges related to aging. Through advances in artificial intelligence (AI), data science, crowdsourcing, Internet of Things (IoT), virtual and augmented reality (VR/AR), human factors research, gerontology and other fields, LILY's innovative technologies form an age-friendly technological ecosystem that is part of the foundation of an ageless society.

AI appears to be a part of several of the projects at LILY. Could you give us an overview of how AI can help in enabling the elderly to lead an active, healthy and dignified lifestyle?

AI is an important part of our key enabling technologies and we have more than 20 years' experience in AI related research. Coupled with other enabling technologies, AI can automate the process of data analytics on various data captured in different forms, e.g. performance data from playing games, daily living data from IoT sensors, etc. such that useful insights can be generated which can be utilized by caregivers including doctors, family members and community volunteers. This complements the traditional manpower-demanding care model and helps in enabling an active, healthy and dignified lifestyle for senior citizens.

One of the [project pages](#) mentions "a delicate balance between user control and smart enabling technologies" is required for user trust. How do you know what is the balance and how is it achieved in the solutions?

The balance requirement is obtained through our trial process with the ageing-in-place project. To evaluate and fulfil the requirement, iterative user-study methodology was adopted throughout the whole project to evaluate end-user experience under various trade-off designs between automation and user control.

Above photo: Visit to St. John's Home for elderly persons on 15 January 2017/ Credit: NTU

How does the team approach the teaching and implementing of smart technology tools when most of the elderly do not have any prior experience/training in using these technologies?

It is true that through our interactions with senior citizens, a large portion of them do not have any prior experience with electronic devices. To mitigate this problem, human factors design plays an important role. We strive to present the elderly with simple user interactions which require little time to learn.

The trick is to let computer interactions mimic how similar activities in the physical world normally take place so that complex technologies can be dissolved into everyday use.

Can you tell us about the ongoing test-bedding of technologies as part of [NTU's community engagement](#) in the HDB (public housing in Singapore) heartlands and expected outcomes and the partnership with Tan Tock Seng Hospital?

We have established close collaborations with a number of local community organizations. To date, we have participated in more than 30 community events in Singapore to promote awareness of ageless ageing technologies to the public.

Our Physio-Cognitive rehabilitation games and Ageing-in-Place technologies have been installed in a few places including NTUC Health Nursing Homes. Last year, we were invited to provide technical support with our crowd AI technologies to a local community centre for their project to develop an on-line portal collecting historical photos and stories from local residents to promote inter-generational bonding. We hope that through the successful test-bedding, our developed technologies could be transferred and deployed on a wider scale to benefit more senior citizens in Singapore.

Above photo:Visit to NTUC Health nursing home on 24 February 2017/ Credit: NTU

We have been working closely with Tan Tock Seng Hospital (TTSH) since 2014 when a collaboration MOU was signed by the two parties. By synergizing the technical strengths from LILY and the medical care strengths from TTSH, we have jointly delivered several impactful projects, e.g. Basketball Genius, which have been successfully test-bedded at TTSH and several community centres. Last year, two teams from LILY and TTSH clinched the 1st prize and the 2nd prize in the Health Innovation Technology competition which attracted more than 130 participating teams.

Are there other government agencies/research institutes that LILY is working with for the development/trial?

LILY is an international collaboration with joint efforts from NTU and The University of British Columbia, Canada and is funded by the National Research Foundation, Prime Minister's Office, Singapore under its IDM Futures Funding Initiative. In the past five years, we have established partnerships with over 20 local and international organizations from academia and industry. Our Silver Games have been exhibited at the iExperience Centre of IMDA, Singapore since 2015. We have signed collaboration agreements with research institutes from top universities including the University of Bristol, UK, and Tsinghua University, China.

Does LILY have any plans for future roll-out or commercialisation of the technologies being developed through industry partnerships or collaboration with government?

LILY places a strong emphasis on maximizing the impact of the developed technologies through technology transfer and commercialization. As a next step, we aim to roll out several developed technologies through collaboration with industry partners and the spin-off of startup companies by our own researchers.