IEEE Workshop on Multimodal and Alternative Perception for Visually Impaired People (MAP4VIP)

General Chairs: Zhigang Zhu, Zhengyou Zhang, Kok-Meng Lee, Yann LeCun
Program Chairs: Shawn Kelly, Tony Ro, Yingli Tian
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Panel Discussion: Vision for the Blind: Need, Challenges and Hope

Co-Chairs: Shawn Kelly (Carnegie Mellon University) and Tony Ro (City University of New York)
Panelists: Barbara Campbell, James Coughlan, Kok-Meng Lee, Francis Quek, James Weiland, Mohammed Yousuf, David Zhou

********** **Questions in bold,** *answers after the workshop in italics starting with panelist name initials,* general comments from during the panel in plain text
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1. What is the best quality of patient assistive device that you think might be developed within the next 5 years. What would such a device allow currently-visually-impaired people to do?

[SK] The best quality implant in the next 5 years will have roughly 256 independently-controllable pixels. This will open the door for somewhat better vision than is reported now, but there is still research to be done on encoding algorithms.

[JC] Computer vision/crowdsourcing-based smartphone apps will exploit increased processing power and camera quality to perform high-quality object recognition. (In particular, such apps will be able to use very wide-angle lenses -- which may be mounted on eyeglasses or worn on clothing -- in conjunction with images with many megapixels, to make it easier for blind users to aim the camera so as to capture the visual features of interest.) Such apps will make it much easier for visually impaired people to navigate (both indoors and outdoors), recognize people, read documents and interact with electronic devices that are not accessible to most blind people.

– Discussion about how a device has to be effective, reliable and easy to use; it's hard to make technology that's more effective than a white cane.

2. What are some of the biggest challenges and obstacles that visually impaired individuals may face in their everyday lives?

[SK] Navigation in unknown locations, identifying signs, streets, crosswalks, etc. Identifying objects, such as selecting among similar boxes in a kitchen pantry.

[JC] Reading, finding their way safely both indoors and outdoors (especially in unfamiliar places, which may be difficult to access without the ability to drive), operating electronic devices, accessing websites that are graphics-intensive, cooking, employment and socializing (which may require challenging travel tasks).

- Amy Nau mentioned that many people have limited access to recreation. For instance, going to the symphony alone requires you to travel to the symphony (often at night), which can be a challenge. Mohammed Yousuf pointed out the work on connected vehicles, which could result in technology that makes travel easier for everybody, including pedestrians and wheelchair users. Francis Quek said that information access is becoming increasingly important to everyone in society, but is difficult for many visually impaired people to achieve.

3. What are some of the current limitations in developing visual assistive technologies?

[SK] Hermetic packaging is limiting the number of independently-controlled channels of prosthetic devices. Continuing technological development will push this boundary.

[JC] I think a very important limitation is funding. It is difficult to run a sustainable business based on developing visual assistive technologies, so for most of us the obvious alternative is to apply for government funding. However, such funding is difficult to secure, and the shortness of funding cycles make it difficult to translate research into commercial products.

A second limitation is the difficulty of software development on portable devices such as smartphone and tablets. While such software development is getting easier, it is still much more challenging than programming laptops and desktops. Also, the landscape of portable devices is extremely fragmented -- for example, once an app is developed for Android, a lot of work remains to translate it to the iPhone platform. And, once an app is developed, it takes a fair amount of work to maintain compatibility with new versions of hardware/software platforms. (I am looking forward to the release of the Ubuntu smartphone!)

[KML] Computer vision hardware and algorithms have been very well developed in terms of imaging and processing capability. However, current vision systems being used for prosthetic eyes, in general, rely on digital vision technologies that were developed in the late 1980s for machines (or robots). Unlike machines

which rely on quantitative data to make a decision, human brain uses imaging information qualitatively. The challenge is to develop an effective means to transfer information into human brain without depending on a large number of electrodes which currently severely limit the human vision performance in terms of resolution and depth perception.

- David Zhou pointed out that the Argus II project is so long-term that it would have been impossible to fund it with government grants (in the US), which is why Second Sight has vigorously pursued long-term private funding.

4. What considerations are used to determine whether an assistive technology device will be adopted and widely used (e.g., cost, size)?

[SK] Functionality (does it do what it says it will, and do it well and repeatably?) and ease of use are the two main considerations I have heard from blind people.

[JC] The most important consideration is whether the device solves a real problem, and solves it sufficiently well, in terms of performance (speed and accuracy are very important), ease of use, cost and convenience. Also, it is important to identify which users will benefit most from a device, and which users will not. For instance, a visually impaired person with a severe hand tremor may not be able to use any camera-based device. Finally, it is important to provide training opportunities for new users; some users may need hands-on training, while others may simply need to read the device manual.

[KML] 1) The device must be simple and work reliably the way it has been designed for. 2) Reasonable performance-to-cost ratio. 3) For uses by human, any device must make use (not replace) human brain and must allow for self-learning/improvement mentally over time.

5. What types of standardized, scientific tests can we perform with visually impaired people to quantify the improvement in performance of visual tasks and in quality of life across the wide variety of available assistive devices?

[SK] This is a challenging question, but some work needs to be done in this area to compare different types of prostheses, as well as the wide variety of assistive devices. Standard tests for prostheses should include both measures of visual performance (acuity, field of view, etc.) and measures of improvement in ability to perform certain visual activities of daily living (navigation, object identification, etc.)

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*While standardized, scientific tests are important, I would like to emphasize the need for testing larger numbers of users (100s of users, much more than the usual N=5 users in most studies that I publish and read), with great attention paid to *qualitative* data about user experiences. Large numbers of users and qualitative results are important for dealing with the huge variability of the blind and visually impaired population.*

- James Coughlan mentioned that he would love to find papers/books on which statistical approaches to use, since different approaches are used in different fields. Francis Quek said that you often need to invent the right metrics that are specific to the particular tasks being measured, since the tasks are so complex. Someone pointed out that developing good metrics for research into assistive devices is a big challenge in itself, and it is important to persuade funding agencies that a fair amount of research needs to be focused into developing these metrics, before devices can be properly evaluated.