

# Vision, Brain and Assistive Technologies

## Rationale

Based on the World Health Organization 2012 Report, there are more than 285 million visually impaired people, of which 39 million are blind. About 65% of all people who are visually impaired are aged 50 and older, while this age group comprises about 20% of the world's population. With an increasing elderly population in many countries, more people will be at risk of age-related visual impairment. Research on multimodal and alternative perception will have a long term impact on the health and wellness of society, not only for the visually challenged, but for people who often work in dangerous environments, such as firefighters, drivers and soldiers.

## Course Description

This course will discuss modern vision science and explore how the brain sees the world, thus including introductory on computational neuroscience, motion, color and several other topics. Then the basics of computer vision will be introduced, for both preprocessing and 3D computer vision. Finally, we will discuss the needs and state-of-art in sensing, processing and stimulation for assisting visually challenged people (blind and visually impaired people) using advanced technologies in machine vision, robotics, displays, materials, portable devices and infrastructure.

The course will be offered as an interdisciplinary seminar course, in which a few lectures will be provided from the recommended textbook on human vision as well as the lecture notes of the instructor on computer vision, and then students from mathematics, physics, electrical engineering, computer science and psychology and other social sciences will be assigned to read, present and discuss materials in vision, brain, computing and devices for assisting the visually impaired. The major reading materials will include the papers and talks from the references below. Finally students will team up to do course projects.

## **Topic List**

Topics may include but are not limited to:

- Introduction to Human and Computer Vision
- Human Eyes and Visual Brain
- Depth and Color
- Image Formation: Digital Image Basics
- Image Enhancement
- Camera Models
- Stereo Vision and Visual Motion
- Assistive Technologies for the Blind and Visually Impaired
- Visual Prosthetics
- Vision Algorithms for the Blind and Visually Impaired

## **Learning Objectives**

Through the course, the students should be able to:

- Demonstrate basic knowledge of human brain and vision, visual impairment, and computer vision
- Identify need of visually impaired people and related assistive technologies
- Apply computer vision algorithms/techniques and assistive technologies to assisting visually impaired

## **Assessment**

Grading policy:

- an in-class exam of the basics theory (30%)
- student reading reports and presentations (30%)
- project reports and presentations for applications(40%).