Google Glass Interaction Techniques for Deaf and Handicapped Users

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First printing, July 2014

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Preface

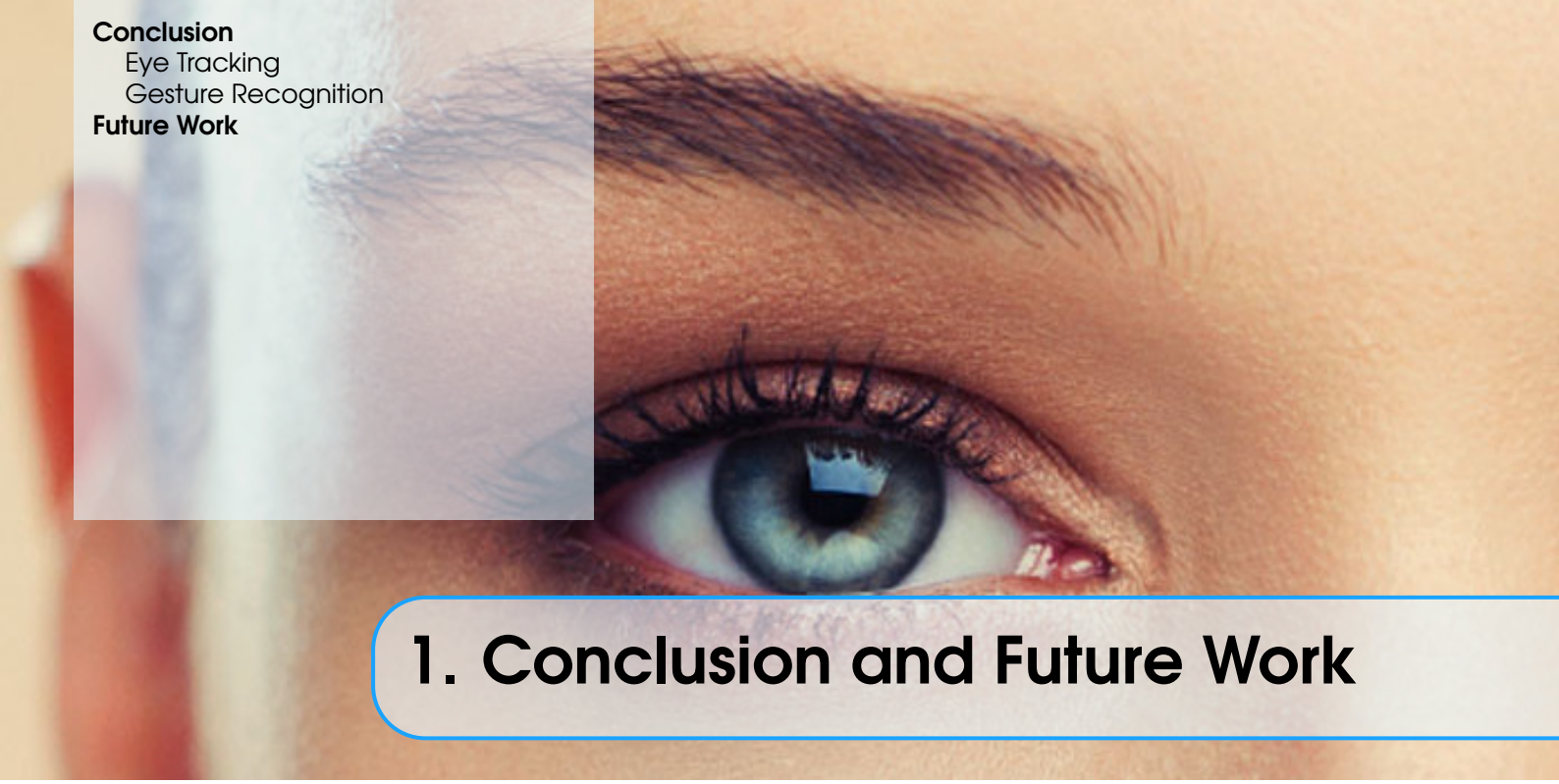
Abstract

With the ever-increasing diffusion of wearable computers in our lives, and the increasing time we spend using such devices, developing new techniques that ease interaction with computers has become insistent. One of the most interesting topics in this field is how to allow user to interact with computers without the traditional mode of interaction (mouse, keyboard and even touch-screen). We believe that eye tracking and gesture recognition seem to be very appealing technologies to achieve this goal.

Wearable gadgets like Google Glass is a promising example of ubiquitous computers that might be a an essential part of our lifestyle in the near future. Glass displays information in a smartphone-like hands-free format, that can communicate with the Internet via natural language voice commands. In this project, two new glass interaction techniques are proposed namely; eye tracking and vision-based gesture recognition.

Eye motion tracking serves as powerful tool to know the user's point of gaze and attentional state. Hence this information is used to increase the responsiveness of the computer in respond to users actions. Moreover eye-motions can be translated into commands for Glass. Another feature of eye tracking is that it can be used to provide aid to people with disabilities hindering them from casual interaction with wearable gadgets.

Gesture recognition has the potential to be a natural and powerful tool supporting efficient and intuitive interaction between the human and the computer (Glass). Visual interpretation of hand gestures can be interpreted into commands for Glass which definitely will help in achieving the ease and naturalness desired for Human Computer Interaction (HCI). Interpreting sign language is a very promising application of gesture recognition, offering an easy alternative way of interaction that will help many deaf people.



1. Conclusion and Future Work

1.1 Conclusion

Though this book we developed two HCI techniques that offer a new experience interacting with wearable smart gadgets. It is largely a software concern; when software, hardware, or a combination of hardware and software, is used to enable use of a computer by a person with a disability or impairment. We believe that that the techniques we discussed in this book will ease the accessibility of wearable computers.

1.1.1 Eye Tracking

Using eye tracking we implemented different algorithms; Starburst [2] and Pupil [1]. Starburst combines feature-based and model-based approaches to achieve a good trade off between run-time performance and accuracy for dark-pupil infrared illumination. The goal of the algorithm is to extract the location of the pupil center and estimate point of gaze. Pupil maintains the same goal, however pupil is more robust and accurate. A notable remark is that both algorithms locate the dark pupil in the IR illuminated eye camera image. Hence both algorithms can not be used outdoors in daytime due to the ambient infrared illumination.

Then we proposed our novel eye-tracking method; MIRT: Morphological Based Iris Tracking. Unlike the previously discussed algorithms, MIRT uses visible imaging to track the iris. We didn't try MIRT in outdoor environments. We expect that the algorithm shall work outdoors after some minor modifications since we use visible spectrum imaging using traditional camera.

1.1.2 Gesture Recognition

... ADD HERE GESTURE CONCLUSION

1.2 Future Work

A number of improvements to MIRT algorithm can be made. For example the algorithm could be updated to work in outdoor environments. Moreover the algorithm implementation can be produced as a package that offer a standard API so as to be integrated in other applications. Speaking of the head set, we developed our cheap eye-tracking headset. During development we used a custom hand made prototype. We are willing to design the headset such that parts that hold the camera to the frame could be 3D printed.

... ADD HERE GESTURE FUTURE WORK

Last but not least, the whole system can be integrated to work with hand held smart devices. We already began to migrate to Android. No to mention that most wearable computers are Android based (i.e Google glass). In Google I/O 2014, Google released a development kit for wearable gadgets. Our system can be modified to work with the new development kit.

Bibliography

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[2] Dongheng Li, David Winfield, and Derrick J Parkhurst. “Starburst: A hybrid algorithm for video-based eye tracking combining feature-based and model-based approaches”. In: *Computer Vision and Pattern Recognition-Workshops, 2005. CVPR Workshops. IEEE Computer Society Conference on*. IEEE. 2005, pp. 79–79.

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