International Conference on Medicine Meets Virtual Reality 13

Final Report

Aristotelis Dosis

The surgical skills assessment research field consists of the clinical side, such as, the qualitative measures of acquiring dexterity and the non-clinical side e.g. dexterity quantitative measures, such as the number of hand movements within a certain time period, hand path length, time, hand velocity etc). Although there is a broad range of research material on the clinical side, there are comparatively new resources and limited expertise on the technical side. Therefore our aim for this conference was to present our perspective to surgical skills assessment area by means of incorporating stochastic models on the current assessment methodologies. More specifically, the objectives can be outlined as follows.

Firstly, to let the research community be aware of our methodology and to present the latest results of our work. The secondary task was to validate our approach and to seek for feedback among those who specialize in the same area. Thirdly, to network with senior academics or leading groups and establish a joined collaboration by sharing information and/or technical knowledge and finally, to keep updated with other groups' work and future developments.

Besides the key objectives of this visit, I personally found this conference to be very helpful, besides extremely valuable experience because I evaluated my methodology by getting feedback from people working on Hidden Markov Models such as Dr J Rosen and Prof B. Hannaford, Dept of EE, University of Washington. Additionally, I occasionally took the opportunity to defend my work during and after my talk.

One of the hardest things in conferences is to target individuals and to discuss specific issues immediately after a session. People often tend to go for a professional lunch/dinner, or they are approached by others, therefore it is important to be at them on time. On the other hand, due to the

'academic' nature of those meetings you have to maintain a discrete 'direct' approach whilst be on subject when talking with them.

It is true that in every large conference, attendees must cope with the problem of parallel sessions. It is practically impossible to attend multiple sessions simultaneously unless there is cooperation with colleagues to attend sessions independently and at the end to exchange notes and discuss/criticise all given talks. My supervisor, Dr Fernando Bello and myself devised a talk attendance timetable every evening and decided which talks should be given higher priority.

Our paper with the title "Laparoscopic task recognition using Hidden Markov Models" was accepted as an oral presentation. Generally, it was received with great interest, especially by surgeons who liked the idea of developing an automatic system to recognize all steps within a real procedure only by capturing the hand movements.

One of the questions that have been raised by the audiences was the accuracy of the recognition rate of the proposed methodology. The answer to this question was that high recognition rates achieved after optimizing our system. It is clear that before optimization we had to face all the common pattern recognition problems such as dealing with similar patterns, pre/post-processing problems, maximizing small pattern differences and changing parameter values within our recognizer to maximize performance.

A second question came from a competitor group working on the same field commenting on whether our system can differentiate between surgical skills expertise levels. The reply was that in our paper, we do not claim that our methodology recognizes levels of surgical expertise and therefore we do not claim that we can use this methodology to assess surgical dexterity. In contrary, we suggest that this technique has the potential to be engaged into more complex tasks and hopefully be able to recognize steps within a surgical procedure. It would be ideal to use this technique in the future to recognize levels of surgical dexterity.

It was particularly useful for our work to attend some other people's work on quantitative surgical skills assessment and especially two presentations from

a group who are working on Hidden Markov Models. Although I am aware of their approach, the type of instrumentation they are using, their custom-made laparoscopic instrument and their type of model, I realized that their surgical skills analysis approach can be adapted into our methodology without great difficulty.

In terms of contacts, it is likely that a future collaboration can be established between the group of the University of Washington and our group. They have a significant knowledge about using Hidden Markov Models in surgery and also about classifying surgical levels of expertise. They also have the experience of developing different types of interactive surgical instrumentation and small robots, thus enabling them to acquire different type of information such as force and torque measures. I has been arranged so that the head of the group Prof. B.Hannaford will visit out department in the middle of March.

There is also another ongoing collaboration with the SUMMIT group of Stanford University regarding a joined project about researching the transferable surgical skills from virtual reality simulators to real procedures. In terms of contacts with the industry it is important to acknowledge discussions we had with Immersion Medical, Intuitive Surgical, Next Limit Technologies and InTouch Health.

Finally, the Royal Academy of Engineering has been properly acknowledged in my presentation slides as well as during informal chatting with other attendees. I would like to conclude this report by thanking the Royal Academy of Engineering and those who have spent valuable time in reviewing my case providing me with valuable assistance towards my travel expenses.

Final Report Signed By

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