



Master's Thesis Proposal¹

General Information

Title: Biofeedback from Automatic Multisensor Corporal Analysis
Expiry Date: 20/3/2011
Modality: technological project
 research work
Advisor/s: Sergio Escalera Guerrero
Advisor's Dept. & Univ.: Sergio Escalera Guerrero
Advisor/s e-mail: sergio@maia.ub.es
Observations:
Student's Name: Miguel Reyes Estany
(if already known)

M.Sc. Thesis Description

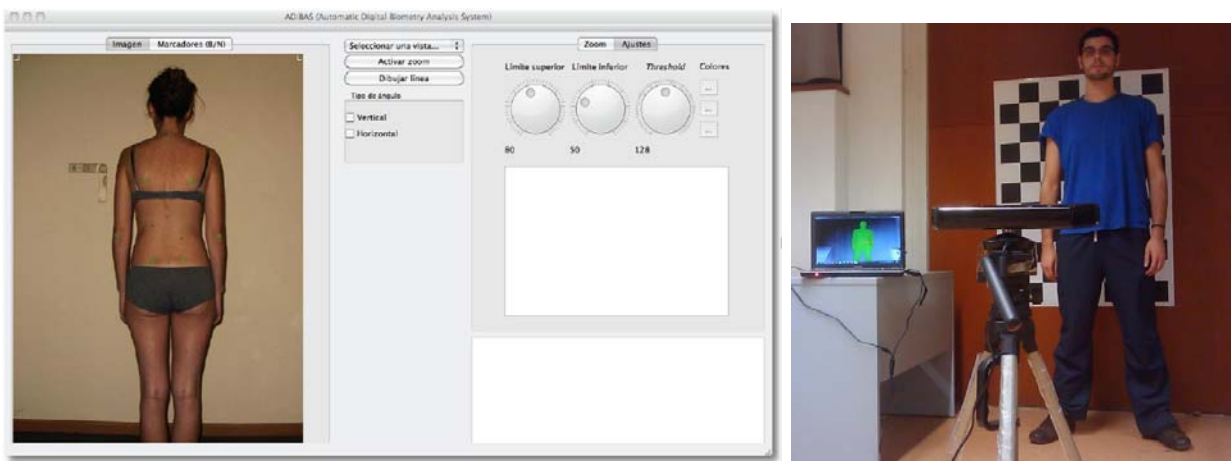
¹ Each M.Sc. Th. Proposal should be in a separate file, named as follows: "MSc-Th-Proposal-2-or-3-title-first-words-Advisor/s-AcademicYear.pdf".

For Example: "MSc-Th-Proposal-Syntactic-and-Semantic-LluisMarquez&JesusGimenez-1011.pdf"

The proposal could be elaborated with any text processor (Word, Openoffice, etc.), but **the file electronically delivered** to LSI Dept. Secretary (merce@lsi.upc.edu) **MUST BE a single PDF file**

Main issues / Brief Description [Mandatory]:

The main goal of this thesis is the design of an automatic system for capturing relevant corporal information from subjects. As a first stage, a set of leds are distributed in the body of the subject. Then, the system is able, by means of a multisensory system, to automatically segment the human body, detect landmarks (leds), and automatically measure the distance and angles among points, helped by a depth map. The biofeedback information retrieved using the present system will be robust and reliable. Moreover, this is a non-invasive system that retrieves objective information and will support diagnosis in the fields on health care and sports. An example of the system is shown in the next figure.



Detailed Description including a task planning [Mandatory]:

The steps of the master thesis are the followings:

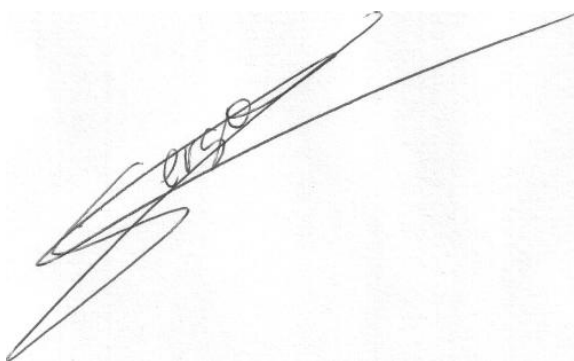
- Analysis: Analyze state-of-the-art system for automatic corporal analysis. Determine the set of sensors that will be the most suitable ones to design a prototype.
 - Design: Design the basic architecture (hardware of the system). Implement automatic Computer Vision processes and Machine Learning techniques for landmark segmentation (color information & mathematical morphology), body segmentation (clustering of depth information), and automatic computation of measures (e.g. distance and angle).
 - Validation: Design of a Ground Truth and computation of measurements in order to evaluate the robustness and reliability of the implemented system.
- Finally, test for future work with the analysis of temporal tracking of landmarks by means of temporal models, such as Dynamic Time Warping and Hidden Markov Models.

References [Mandatory]:

- [1] Posture Print, "<http://www.postureprint.org/>," 2010.
- [2] Deed E. Harrison and Donald D. Harrison et.al., "A normal spinal position: It's time to accept the evidence," *JMPT*, vol. 23, no. 9, 2000.
- [3] Martin C. Normand and Martin Descarreaux et.al., "Three dimensional evaluation of posture in standing with the postureprint," *BCCO*, vol. 15, no. 15, 2007.
- [4] Deed E. Harrison and Tadeusz J. Janik et.al., "Validation of a computer analysis to determine 3-d rotations and translations of the rib cage," *EuroSpine*, vol. 16, pp. 213–218, 2007.
- [5] R. Adams and L. Bischof, "Seeded region growing," *IEEE TPAMI*, vol. 16, pp. 641–647, 1994.
- [6] Derpanis et.al., "The harris corner detector," 2004.
- [7] Z. Zhang, "A flexible new technique for camera calibration," *IEEE TPAMI*, vol. 22, no. 11, pp. 1330–1334, 2000.
- [8] Ying Zhao and George Karypis, "Evaluation of hierarchical clustering algorithms for document datasets," in *DMKD*. 2002, pp. 515–524, ACM Press.
- [9] Allan Hanbury and Allan Hanbury et.al., "Mathematical morphology in the $L^*a^*b^*$ colour space," Tech. Rep., 2001.

Minimal Requirements & Previous Knowledge [Optional]: Basic knowledge on Computer Vision

Other comments [Optional]:

A handwritten signature in black ink, appearing to read 'Sergio Escalera', is written over a light gray rectangular background.

Sergio Escalera

Location and Date: Barcelona, march 20 2011

To the Academic Commission of the Master in Artificial Intelligence (CAIMIA)