CEIG - Spanish Computer Graphics Conference (2012)
Isabel Navazo and Gustavo Patow (Editors)

Non-rigid 3D faces registration using geodesic distance maps

T. Gurguí[1] and F. Poveda[2] and E. Martí[1,2]

[1]Center of Ambient Intelligence and Accessibility of Catalonia, Universitat Autònoma de Barcelona, Spain
[2]Computer Science Department, Universitat Autònoma de Barcelona, Spain

Abstract

3D facial mesh registration is a key step in 3D facial analisys. This process calculates a mapping between faces in order to put in correspondence each point of both faces. In this poster we introduce a new approach for 3D face registration based in geodesical distances and 2D non-rigid registration.

1. Introduction

3D facial expression analysis tries to extract information from a 3D representation of real human faces. Most of methods, need several samples to extract relevant information. In order to do so, registration is a key step, as it puts in correspondence the different parts of faces.

We present a new method for 3D facial meshes, using geodesic distances and non-rigid registration algorithm.

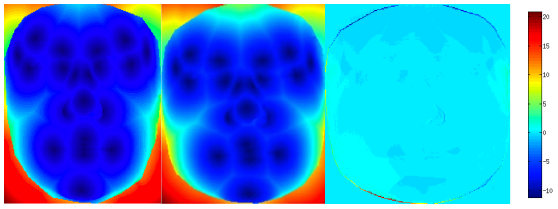
2. Methodology

Our methodology pursues the registration of 3D surfaces using a 2D representation of them. Considering the surface as a 2D height map, the first step has been to obtain a geodesic distance map. This distance map encodes the minimum distance to the nearest landmark in each pixel through the surface (see fig. 1b). With this map we wanted to take into account the morphology of the surface as well as the landmark information. This selection is better suited than texture, as some texture areas present no sufficiently distinctive information for a robust registration.

Once the distance map is constructed, we apply demons non-rigid registration algorithm [CPA99]. Demons algorithm uses pixel intensities to calculate a displacement map between two images. In our case, this intensity corresponds to a distance. Taking one face as a reference, we register the rest. In this way, we are able to have dense correspondence for the complete dataset. Sub-pixel accuracy is achieved by spline interpolation.

3. Results

We have used Bosphorus DB (http://bosphorus.ee.boun.edu.tr/Home.aspx) as dataset, and we have taken 388 examples performing 6 expressions. The database sets landmarks of these expressions using 24 Action Units (AU) defined in FACS [EF78]. Figure 1c shows a measure of per pixel error, between two faces registered with our methodology.



(a) Distance map 1(b) Distance map 2 (c) Error in registration

Figure 1: Results of the method

4. Conclusions

We have achived robust, simple and fast non-rigid facial surface registration. This methodology could be extended to any kind of parametrization rather than the simplest height map considered here and to other kind of landmarks or mesh features.

References

[CPA99] CACHIER P., PENNEC X., AYACHE N.: *Fast Non Rigid Matching by Gradient Descent: Study and Improvements of the "Demons" Algorithm.* Tech. Rep. RR-3706, INRIA, June 1999. URL: http://hal.inria.fr/inria-00072962. 1

[EF78] EKMAN P., FRIESEN W.: *Facial Action Coding System: A Technique for the Measurement of Facial Movement.* Consulting Psychologists Press, Palo Alto, 1978. 1

DOI: 10.2312/LocalChapterEvents/CEIG/CEIG12/166-166