Digital Signal Processing Research Group
DEPARTAMENTO DE SEÑALES Y COMUNICACIONES
UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA - SPAIN

3rd SPLab Workshop 2013
Brno University of Technology – October 2013

Detection of Emotional States based on the mouth opening

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Outline

- Introduction
- Expression Detection vs. Emotional State
- General Idea
- Image Pre-processing
- Mouth Opening
- Interface
- Conclusions and Future Lines
- Acknowledgements

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Introduction (I)

- Technological advances have made possible the proliferation of equipment and latest technologies, making progresses.

- A new innovation is the detection of the emotional state, being the goal of this work.

Introduction (II)

- The purpose of this application is its use for the neurological diseases in humans by the detection of the emotional state
- The idea is to measure quantitatively the emotional state for knowing the grade of the disease, its evolution
- It has been an interaction between Brno University of Technological and ULPGC: from Neurologist.

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Expression Detection vs. Emotional State (I)

- In a typical expression detection and according to FACS (Facial Actions Coding System), it can be found until 8 emotional expressions: anger, disgust, fear, happiness, sadness, surprise, neutral and contempt.

- From them, it is only interesting the neutral expression vs. the rest of expressions.

- It can be detected by Neurologist from visual point of view, but they want to quantify the grade of neutral expression.

Expression Detection vs. Emotional State (I)

- Neurologists have seen the mouth opening is a interesting point to be measure in order to detect the grade of expressions.

- Therefore, this work was motivated by that concept, giving an answer of the diagnosis help by the detection of the emotional state.

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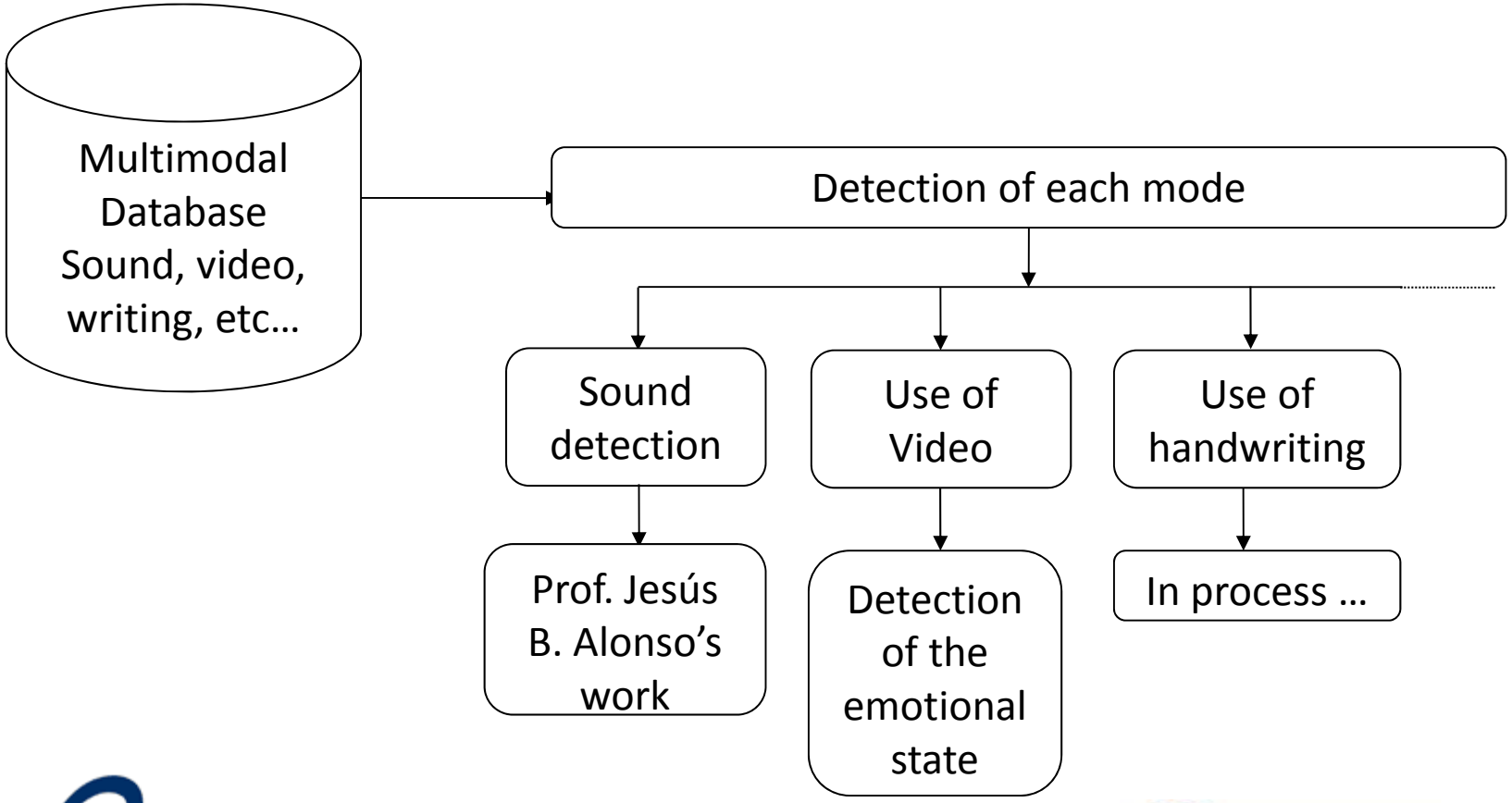
General idea

- The general diagram block of our proposal is;



General idea

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Image pre-processing (I)

- The three steps were involved in this preprocessing stage. It includes:
  - Extraction of the facial area of the input image
  - Colour Transformation
  - Morphological operators and image processing tools

Image pre-processing (II)

- An algorithm based on the face detector from Viola and Jones' method

- Colour Transformation: Blue+Red –k*Green

Image pre-processing (III)

- Morphological operators and filled

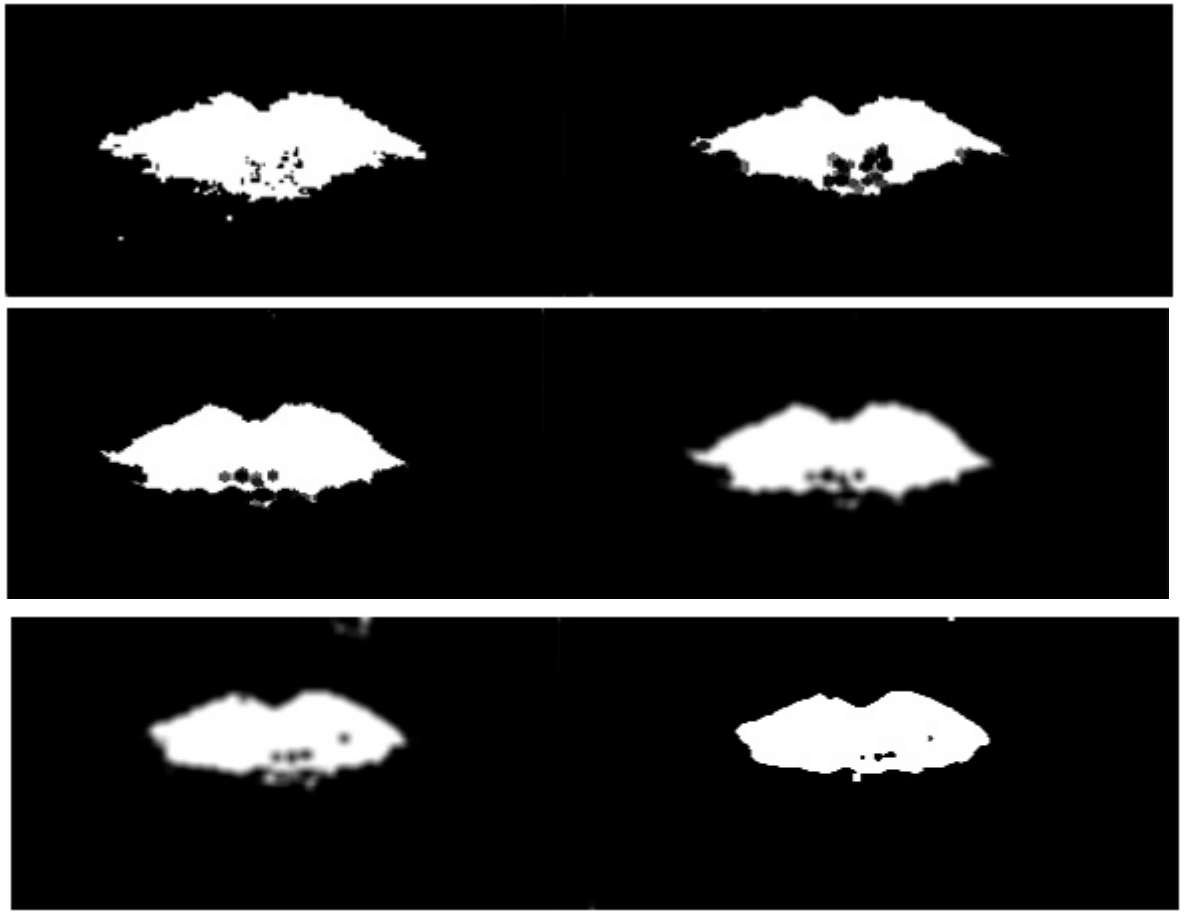
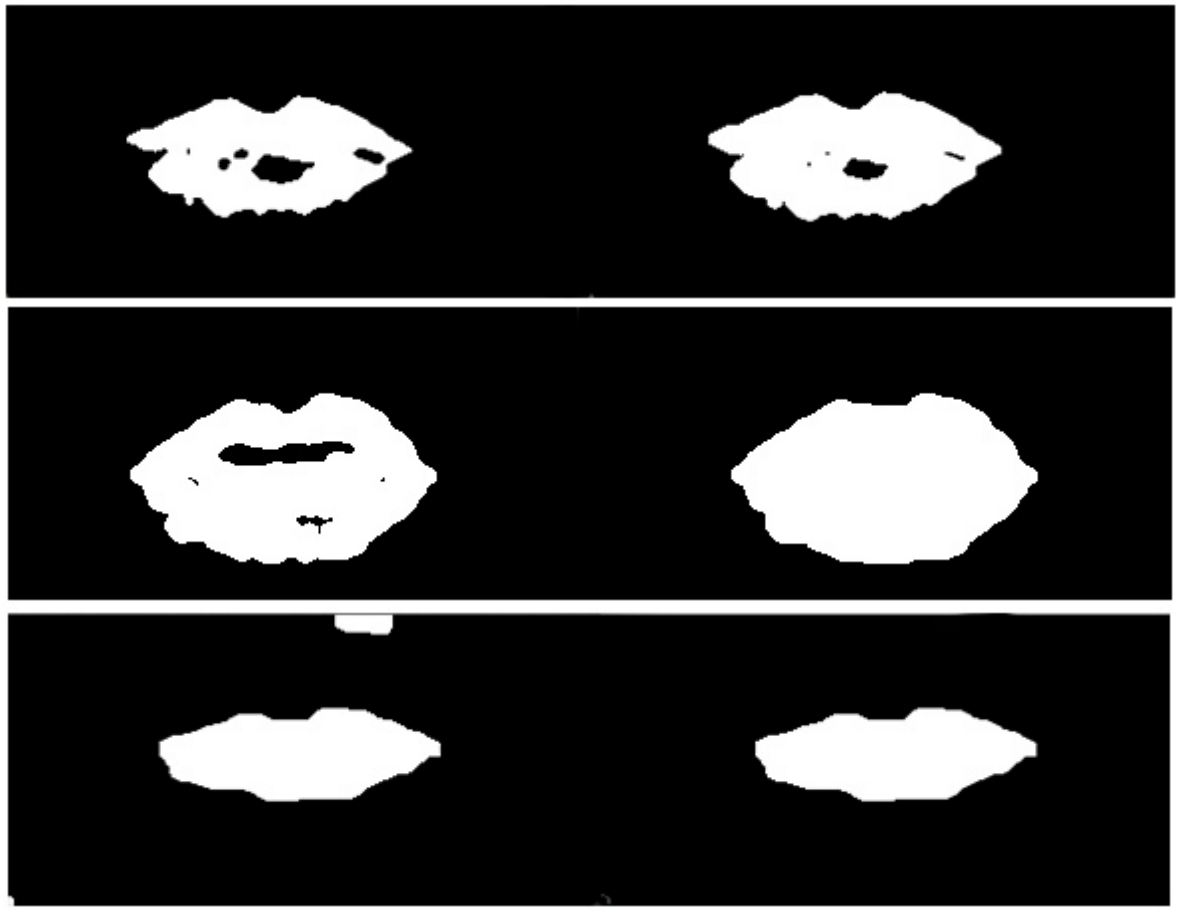


Image pre-processing (IV)

- Morphological operators and image processing tools



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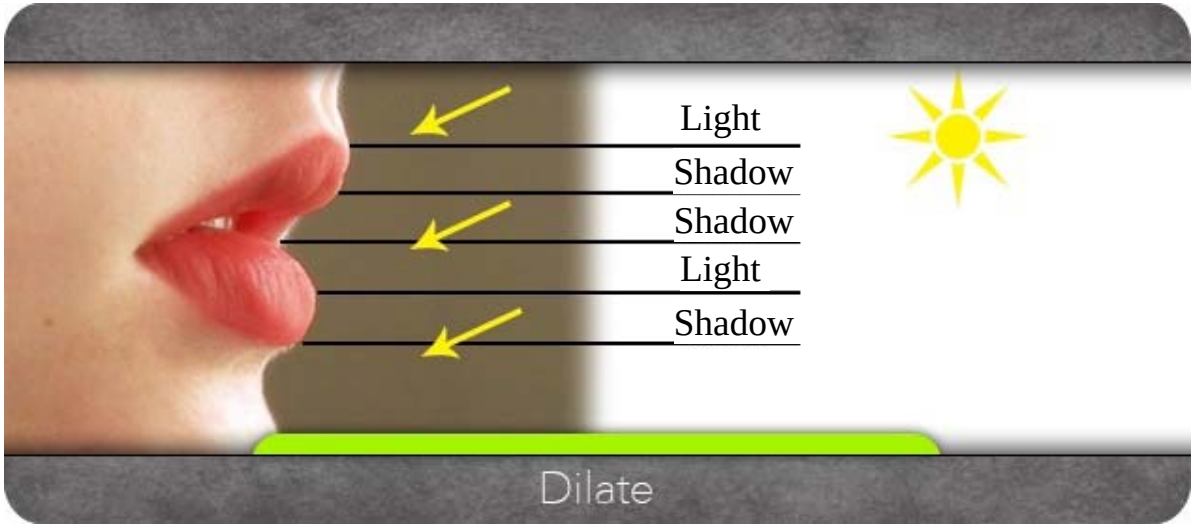
Mouth Opening (I)

- Shape detection

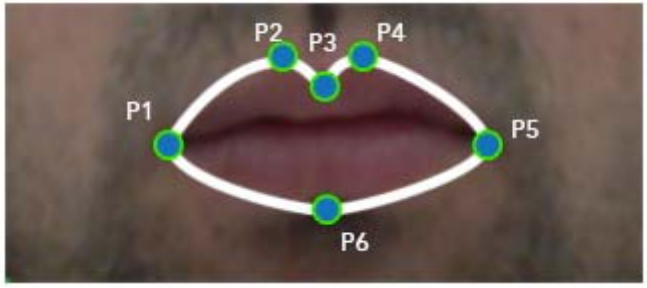
- Mass Centre and polar swept

Mouth Opening (II)

- Variability of the contour



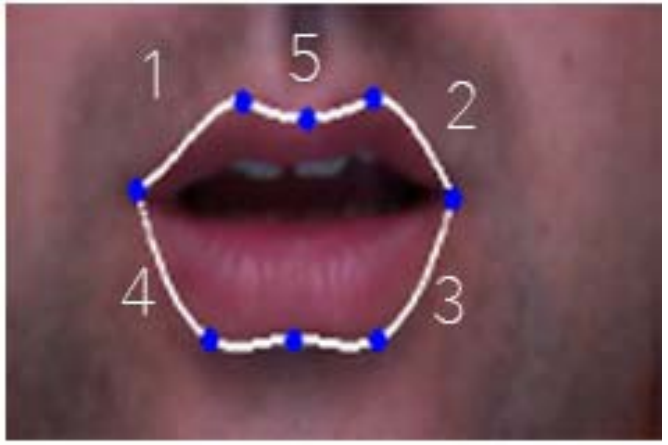
- Approximation of the mouth



Mouth Opening (III)

- Sobel detector

- Spline curves: cubic and cuadratic



Mouth Opening (IV)

- For the measure of the mouth opening, this approach studies the variability of the shape.
- Too, the variability of the mouth area.
- Between both and after the heuristic study, we can detect the emotional state.

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Interface (I)

- Initial version:
  https://www.youtube.com/watch?v=Y7QTjAndc2E
- Intermediate version:
  https://www.youtube.com/watch?v=YfPj41nUBAo
- Final version:
  https://www.youtube.com/watch?v=FPidn4FVNQg

Interface (II)

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Conclusions and Future Lines (I)

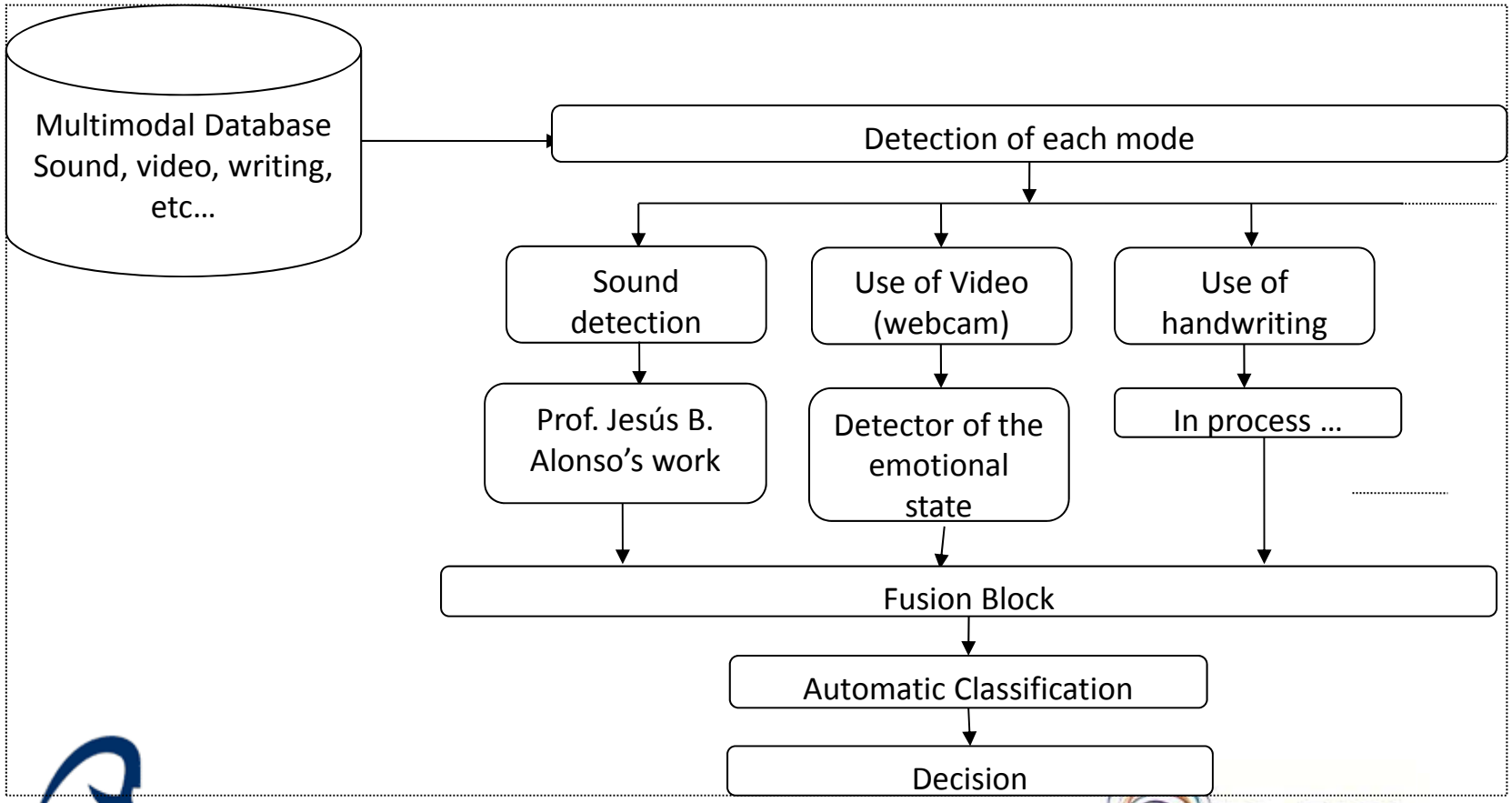
- We have started to develop a detector of emotional states, where the facial expression and voice emotion detection blocks have been done, with good results.

- We are working on the recording protocol, in order to have a multimodal approach.

- In a close future, we will begin to work with writing and the whole fusion block.

Conclusions and Future Lines (III)

- The idea is to use different kinds of sources in order to get a robust emotion detection.



Conclusions and Future Lines (II)

- The next step will be to use a real videos:
  - Some videos from Brno Hospital can be used, thank the managements from Jiří Mekyska.
  - Prof. Karmele Lopez-de-Ipiña wants to use this work on videos for patients with Alzheimer disease.

Conclusions and Future Lines (IV)

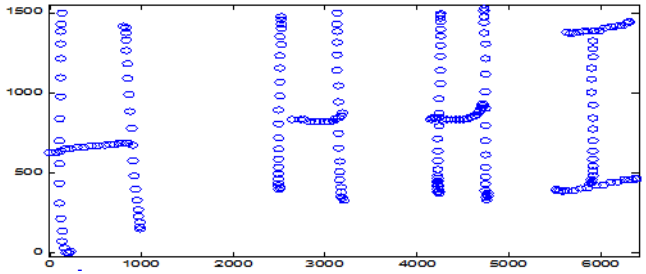
- Another important information source is the use of handwritten information.
- We have a large background working in signature verification and writer identification, under off-line and on-line conditions.
- The idea is the use of online information, because it gives us more details and calculate different kind of parameters.

Francisco Vargas, Carlos M. Travieso, Jesús B. Alonso, Miguel A. Ferrer, Off-line Signature Verification Based on Grey Level Information using Texture Features, **Pattern Recognition**, 44 (2), pp. 375-385, 2011

Omar Santana, Carlos M. Travieso, Jesús B. Alonso, Miguel A. Ferrer, Writer Identification Based on Graphology Techniques, **IEEE Aerospace and Electronic Systems Magazine**, 25 (6), pp. 35-42, 2010

Conclusions and Future Lines (V)

- We are beginning a collaboration with Prof. Karmele Lopez-de-Ipiña, and the idea is to use the following parameters as measure of the Neurodegenerative diseases;
  - Number of strokes
  - Variability /Tremor
  - Time
  - Pressure
  - Derivation
  - Temporal evolution
  - etc ....



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Acknowledgement

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- Thanks for Jiří Mekyska and Vladimir Červenka, our meetings have reached a good destination.

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