Teaching and Research

Polytechnic School

University of Vic

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University of Vic

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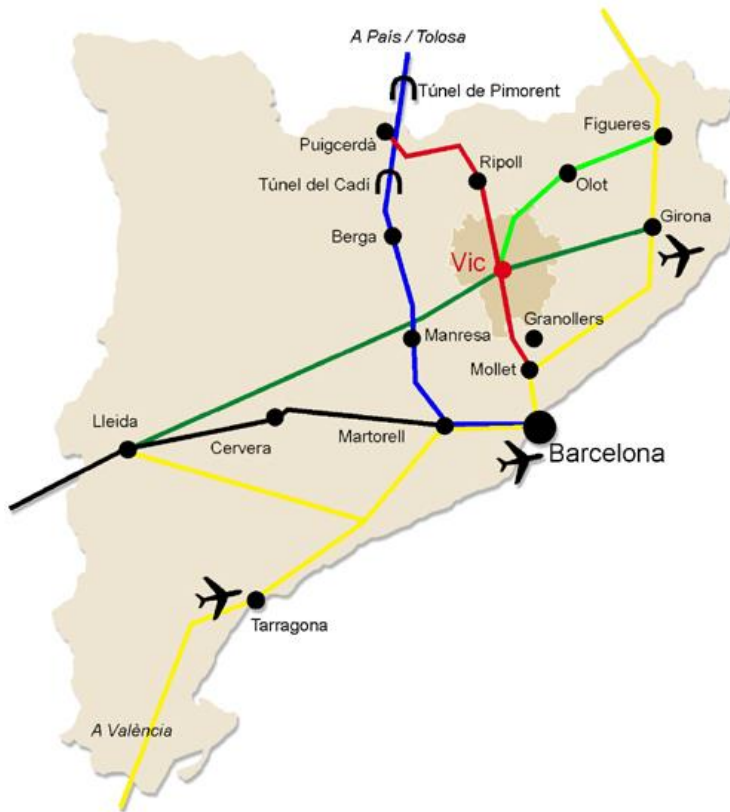
University of Vic

UVIC UNIVERSITAT DE VIC

University of Vic

- Geographical localization

- UVic is located in the city of Vic, a town of 40,000 inhabitants in the heart of Catalonia.
- UVic has 4 main centers:
  - Polytechnic School
  - Faculty of Education, Humanities and Translation
  - Faculty of Business and Communication
  - Faculty of Health and Welfare

and two affiliated centers: EADA Business School and BAU Design School

University of Vic

• More than 5,000 students

Faculty of Education Translation and Humanities

Faculty of Health Sciences and Welfare

Faculty of Business and Communication Studies

Polytechnic School

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University of Vic

Social Sciences and Law

- Physical Education and Sport Sciences
- Pre-School Teaching
- Primary School Teaching
- Social Education
- Social Work

- Advertising and Public Relations (APR)
- Audiovisual Communication
- Business Administration and Management (BAM)
- BAM / APR
- Journalism
- Marketing and Business Communication

Arts and Humanities

- Design (BAU, Barcelona)
- Translation and Interpreting

Engineering

- Industrial Electronics Engineering and Automation
- Industrial Organisation Engineering
- Mechatronics Engineering
- Multimedia
- Biomedical Engineering (2014-2015)

Sciences

- Biology
- Biotechnology
- Environmental Sciences
- Statistics (UAB-Uvic)
- Technology and Food Management

Health Sciences

- Human Nutrition and Dietetics
- Nursing
- Occupational Therapy
- Physiotherapy
- Psychology

University of Vic

- Private management university. Public service.

- Board of governors has the majority of representatives from Vic city council and the Generalitat of Catalonia.

- Participates in public university registration.

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Polytechnic School

Areas of study and research

Engineering	Biosciences

- Degrees Studies

- Masters and Postgraduate

- Doctoral Studies

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Engineering: Degrees Studies

Face-to-face learning

- Industrial Electronics Engineering and Automation

- Mechatronics Engineering

- Biomedical Engineering (2014-15 Course)

Face-to-face / blended learning

- Industrial Organisation Engineering

- Multimedia

Polytechnic School

Biosciences: Degrees Studies

Face-to-face learning

- Biology

- Biotechnology

- Statistics. Interuniversity Degree(UAB-UVic)

Face-to-face / blended learning

- Environmental Sciences

- Technology and Food Management

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Polytechnic School

Engineering: Masters and Postgraduate

Blended / on-line learning

- **Master's Degree** in Apps&Games

- **Master's Degree** in Health and Safety at Work

- Master in Renewable Energies (2014-15 Course)

Face-to-face learning

- Postgraduate in Design Management. Collaboration with BAU School of Design.

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Polytechnic School

Biosciences: Masters and Postgraduate

Face-to-face learning

- **Master's Degree** in Omics Data Analysis

- Master in Rural Planning and Management (2014-15 Course)

Blended / on-line learning

- Master and Postgraduate in Quality and Food Safety: HACCP System.

- Master and Postgraduate in Environmental Management and Sustainability

- Master in Archaeometry. Interuniversity Master (2014-15 Course)

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Polytechnic School

Doctoral Studies

Engineering

Research groups

- Digital Technologies

Areas of Research

- Signal Processing and Modelling

- Mechatronics, Robotics and Materials

- ICT Development and Social Innovation

- Business (Collaboration with Faculty of Business and Communication Studies)

Polytechnic School

Biosciences

Research groups

- Bioinformatics and Medical Statistics

- Environment and Food

Areas of Research

- Statistical Genetics and Medical Statistics

- Genome Bioinformatics

- Computational Structural Biology

- Molecular Simulations

- Food Quality and Safety

Polytechnic School

Engineering

Signal Processing and Modeling

- Automatic pattern analysis

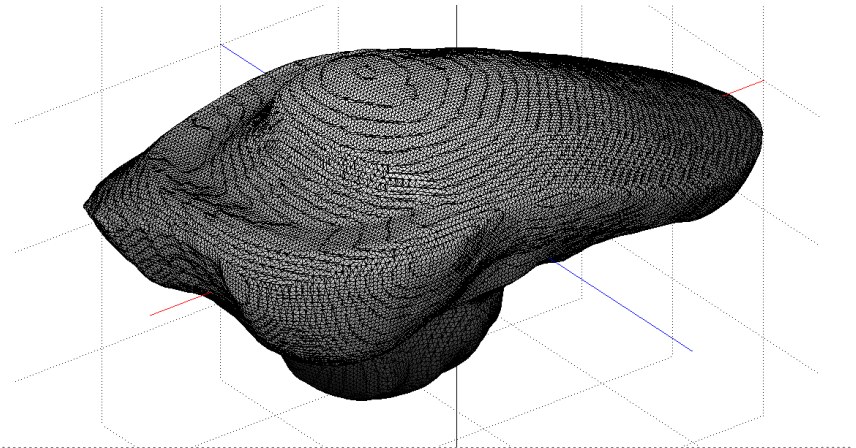   Funded Research Project CSIC-UPC-UVIC (Spanish Government)

    Associated Unit with ICM – CSIC (Spanish Research Council)

- Analysis of stock market data

    one PhD in progress

- Stereoscopic vision

- Volumetric applications with kinect

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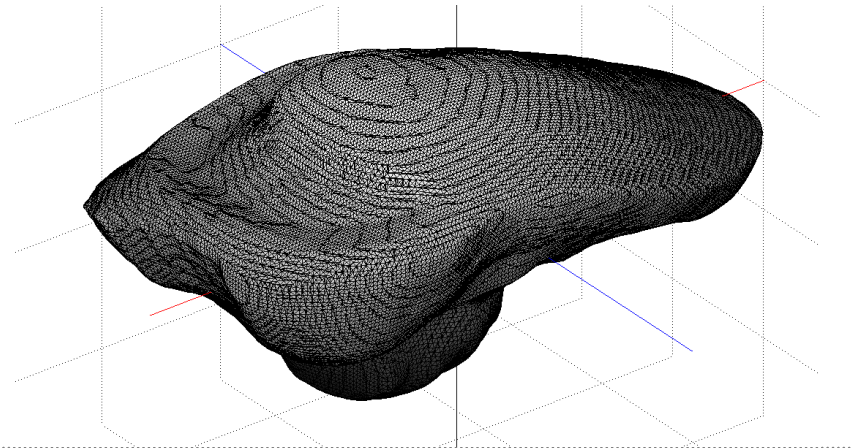
Engineering

Signal Processing and Modeling

• Otolith: shape and size is characteristic for each specie

•Face recognition based on multivariant EMD (mEMD)

• Speech signal processing
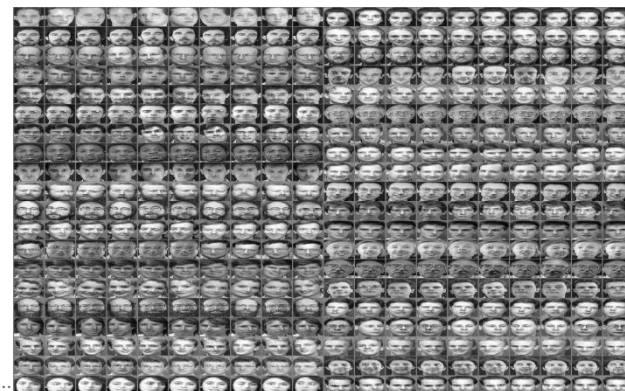
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Engineering

Signal Processing and Modeling

- Automatic pattern analysis

  Funded Research Project CSIC-UPC-UVIC (Spanish Government)

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- Analysis of stock market data

  One PhD in progress

- Stereoscopic vision

- Volumetric applications with kinect

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Engineering

Signal Processing and Modeling

• Biometrics and health

    - Handwriting for cognitive impairments analysis (Funded

       Research Project, Spanish government)

    - Speech processing analysis for Alzheimer's disease detection

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Research Group on Digital Technologies
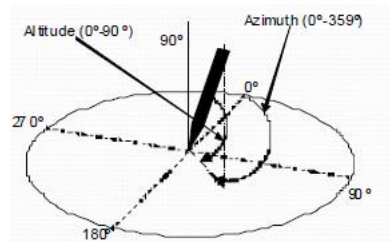
Engineering

Signal Processing and Modeling

• Neurociences

    Brain Computing Interface (BCI)

    EEG signal analysis

        one PhD in progress

    fMRI signal analysis

        one PhD in progress

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Polytechnic School
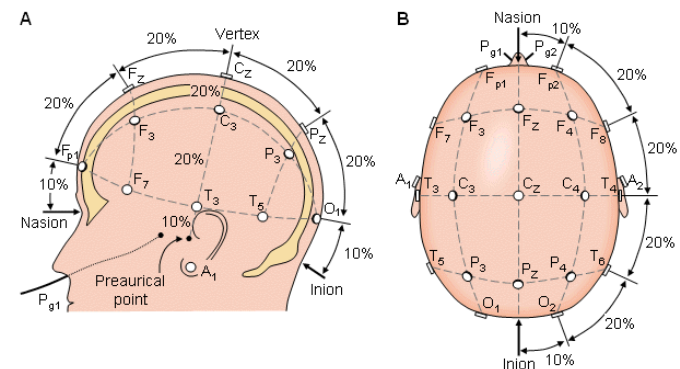
Engineering

Organization of events

- International conferences:

  - BAS (Barcelona Advances in Statistics), 2003, 2008, 2012

  - NOLISP (NOnLInear Speech Processing), 2009

  - BIOSTEC 2012 (International Joint Conference on Biomedical Engineering Systems and Technologies), 2012

 - CCIA (International Conference of the Catalan Association of Artificial Intelligence), 2013

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Engineering

Organisation of events

• Special sessions:

–"Challenges in Neuroengineering", International Conference on Neural Computation Theory and Applications (2013, 2012, 2011)

–"Multivariable Processing for Biometric Systems", International Conference on Bio-inspired Systems and Signal Processing (2013, 2012, 2011)

–"Biometric systems for human-machine interaction", International Work Conference on Artificial and Natural Neural Networks (2011)

–"Neural Signals of Brain Disorders", International Conference on Bio-inspired Systems and Signal Processing (2010).

–"Artificial Neural Networks and Independent Component Analysis", International Work Conference on Artificial and Natural Neural Networks (2003)

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Research Group on Digital Technologies

Engineering

Mechatronics, Robotics and Materials

- Petrography and optical microscopy (OM)

- Metallographic microscopy

- Scanning electron microscopy (SEM)

- Transmission electron microscopy (TEM)

- Electron microprobe (WDS)

- X-ray fluorescence (XRF)

- X-ray diffraction (XRD)

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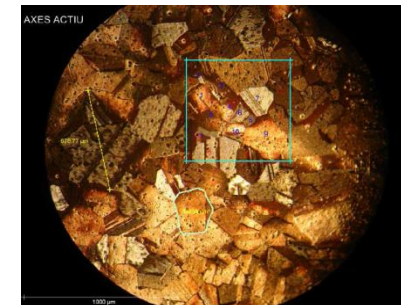
Engineering

Mechatronics, Robotics and Materials

- Colorimetric studies (UV-Vis)

- Analysis of hardness (Vickers, Brinell and Rockwell)

- Calorimetric analysis (DTA, DSC and dilatometrics)

- Analysis of micrometric and nanometric phases with synchrotron light (m-XRD)

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Engineering
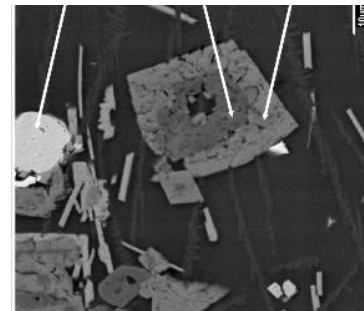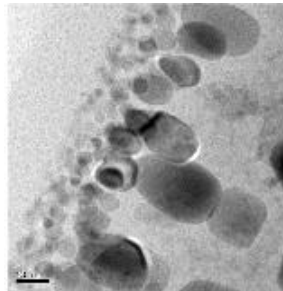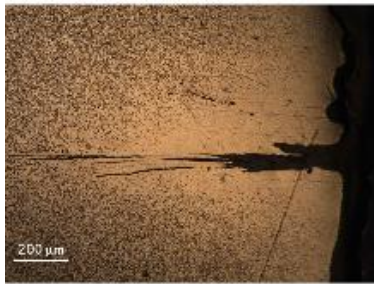
ICT Development and Social Innovation

• SEACW (www.seacw.org)

1.- Creating an ecosystem that can become a meeting point for all those interested in active and healthy aging and elderly inclusion, through ICT.

2.-Training and making people aware of importance of ICT and Aging, and active and healthy aging.

3.- Looking for intergenerational relationships and social networking.

4.- Design and Create Pilot Implementation phase

Polytechnic School

Engineering

ICT Development and Social Innovation

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Research Group on Digital Technologies
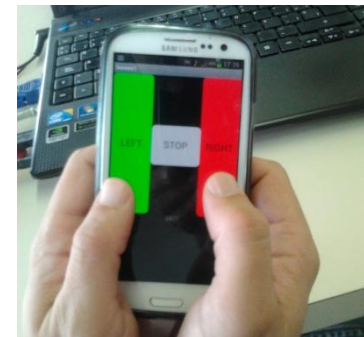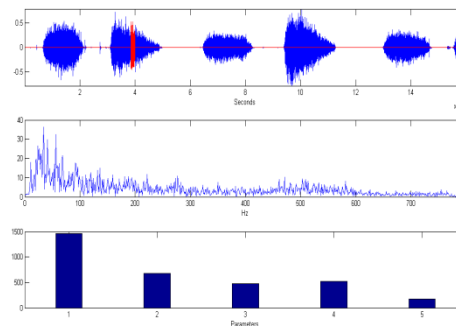
Engineering

SEACW partners:

Research Group on Digital Technologies

Engineering

ICT Development and Social Innovation

- Apps:

  - Low-Complex Breathing Monitoring System Based on Acoustic Signals

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Research Group on Digital Technologies

Engineering

ICT Development and Social Innovation

- Apps:

  - Spotmole: Melanoma control system (www.spotmole.com)

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Polytechnic School

Engineering

Vic Brain Unit

- A recent unit created into the Digital Technologies research group.

- Interested in **biosignals processing**, mainly related to **brain** study.

- Members (alphabetic order):

    - Manel Bartés-Serrallonga (PhD student, fMRI)

    - Esteve Gallego-Jutglà (PhD student, EEG)

    - Josep Mª Serra-Grabulosa (UB, external collaborator, PhD co-supervisor)

    - Jordi Solé-Casals (Head)

    - François Viallate (ESPCI, external collaborator, PhD co-supervisor)

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Research Group on Digital Technologies - Vic Brain Unit

Engineering

- Some **international** collaborators (alphabetic order):

  - Prof. Edward Bullmore (BMU – United Kingdom)

  - Dr. César Caiafa (CONICET – Argentina)

  - Prof. Andrzej Cichocki (ABSP-RIKEN Lab – Japan)

  - Dr. Marco Congedo (GIPSA Lab – France)

  - Dr. Justin Dauwels (Dauwels Lab – Singapore)

  - Prof. Christian Jutten (GIPSA Lab – France)

  - Prof. Elmar Lang (CIML, Univ. Regensburg – Germany)

  - Dr. Tomasz M. Rutkowski (Tsukuba Brain Lab – Japan)

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Engineering

- Some **national** collaborators (alphabetic order):

  - Dr.Jesús Bernardino Alonso Hernández (ULPGC, Canarias)

  - Prof. Marcos Faúndez-Zanuy (EUPMT, Mataró)

  - Prof. Pedro Gómez-Vilda (UPM, Madrid)

  - Dra. Karmele López-de-Ipiña (EHU, Donostia)

  - Dr. Enric Monte-Moreno (UPC, Barcelona)

  - Prof. Carlos García-Puntonet (UGR, Granada)

  - Dr. Carlos M. Travieso (ULPGC, Canarias)

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Engineering

Research fields

1) EEG signal processing

2) fMRI processing

3) Indirect measures of brain activity

      3.1 - Speech

      3.2 - Handwriting

Polytechnic School

Engineering

EEG signal processing

Three main **projects**:

1. Automatic denoising system based on ICA

2. Early detection of AD

3. Exploring mEMD for EEG denoising

Engineering

fMRI processing

• We investigate the effect of the smoothing on the pre-processing steps of fMRI images.

• Typically, Gaussian filters are used:

- The extent of smoothing is chosen independently of the data and is assumed to be equal across the image

- Some regions may be under-smoothed, while others may be over-smoothed.

Research Group on Digital Technologies - Vic Brain Unit

Engineering

fMRI processing

• We propose to use an adaptive Wiener filter which smoothes the images adaptively (minimize the least square error):

   • perform a little smoothing where variance is large

   • perform more smoothing where the variance is small

• We compare the effects of the smoothing with a Gaussian kernel and with an adaptive Wiener filter

Research Group on Digital Technologies - Vic Brain Unit

Engineering

fMRI processing

• Experiment
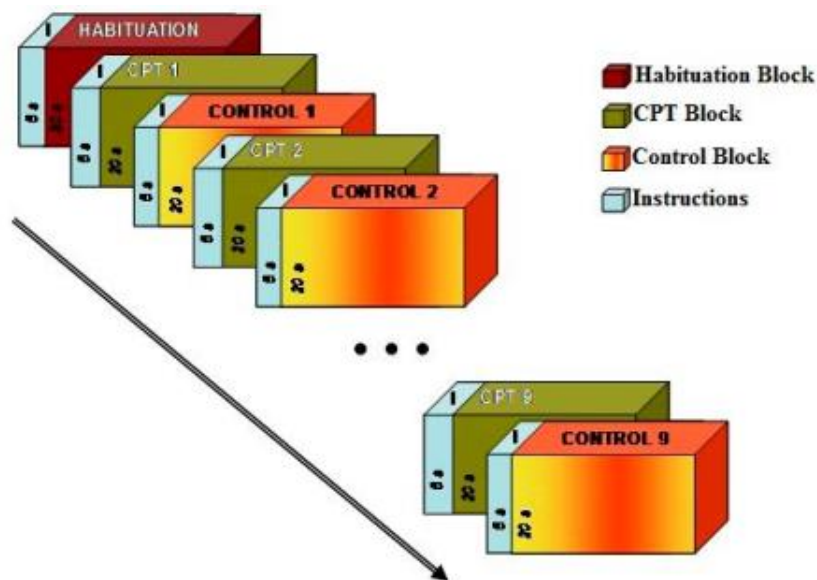
On the top (A), the figures presented in the CPT blocks. In this example, subject should respond to the stimulus e3. On the bottom (B), the figures presented in the control blocks.

Engineering

fMRI processing

- Image pre-processing was performed with SPM8

- Spatial ICA is applied to both types of the smoothed

- Goal: to check if the components obtained with the Wiener filter have a time course more similar to the task pattern than the time course obtained with the Gaussian kernel.

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Engineering

fMRI processing

non smoothed image

smoothed image with
Gaussian filter

smoothed image with
Wiener filter

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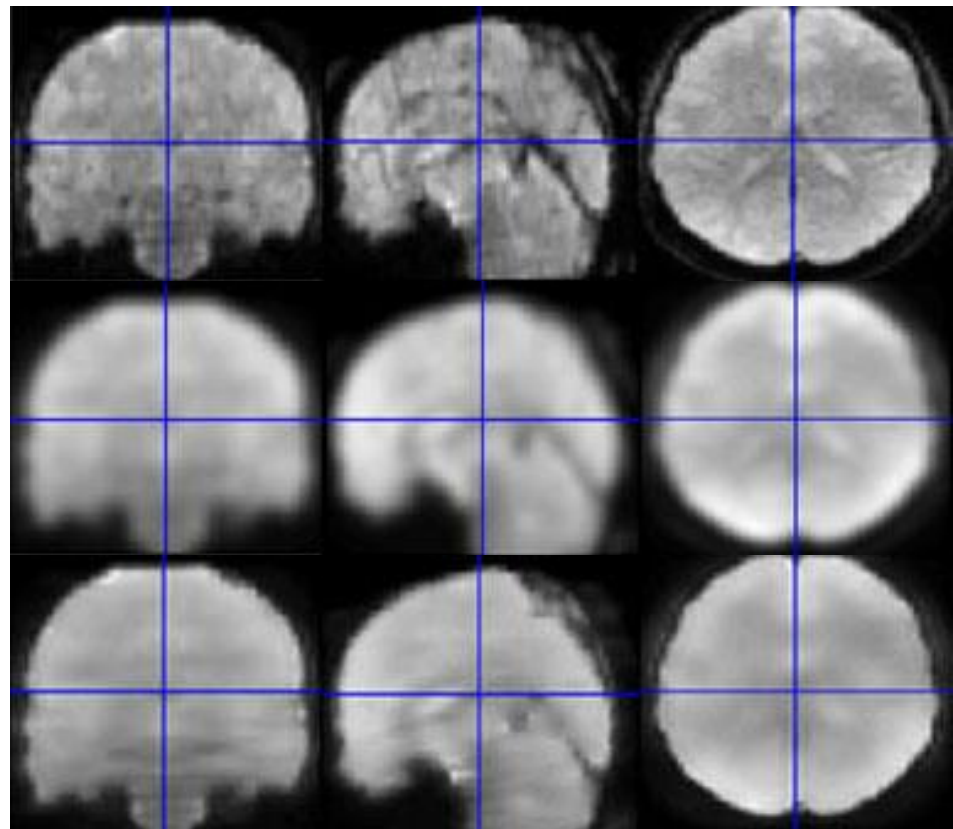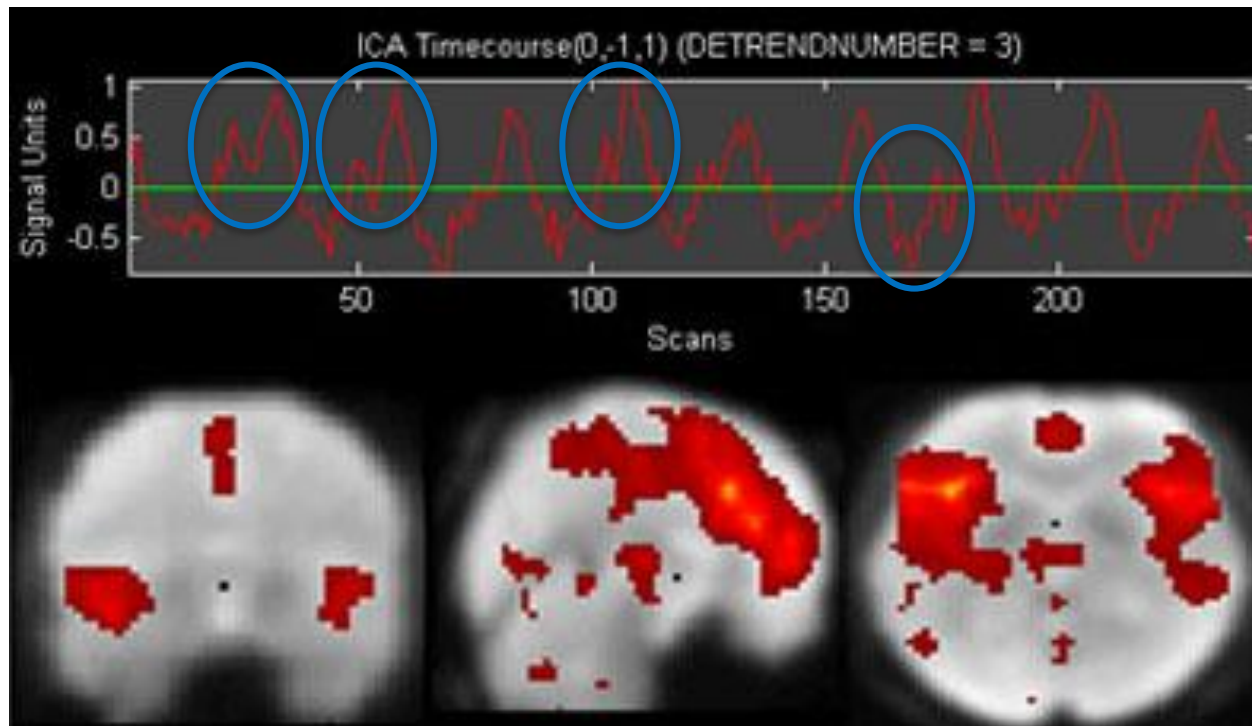
Engineering

Component from the CPT task obtained with the **Wiener kernel**
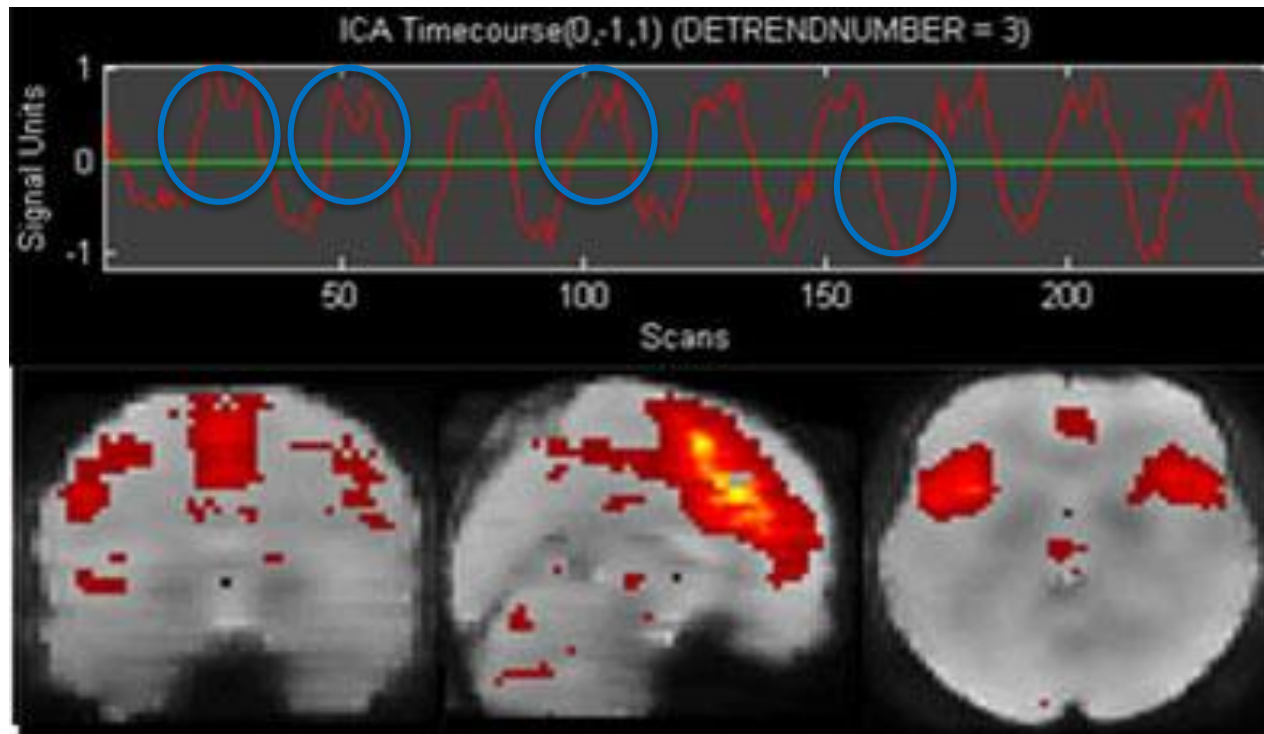
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Engineering

Component from the CPT task obtained with the **Gaussian kernel**

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Engineering

fMRI processing

• Activations found in the CPT task with the Wiener filter are slightly different of the activations found in the CPT task with the Gaussian kernel, mainly for **parietal** and **temporal** regions.

• Wiener adaptive filter finds less active regions: false positives are removed by the Wiener filter.

• Gaussian kernels alter the spatial shape and extent of the activation regions.

• Deeper studies must be carried on in order to improve preliminary results

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Engineering

Indirect measures of brain activity

Two main **projects**:

1.   Speech

2.   Handwriting analysis

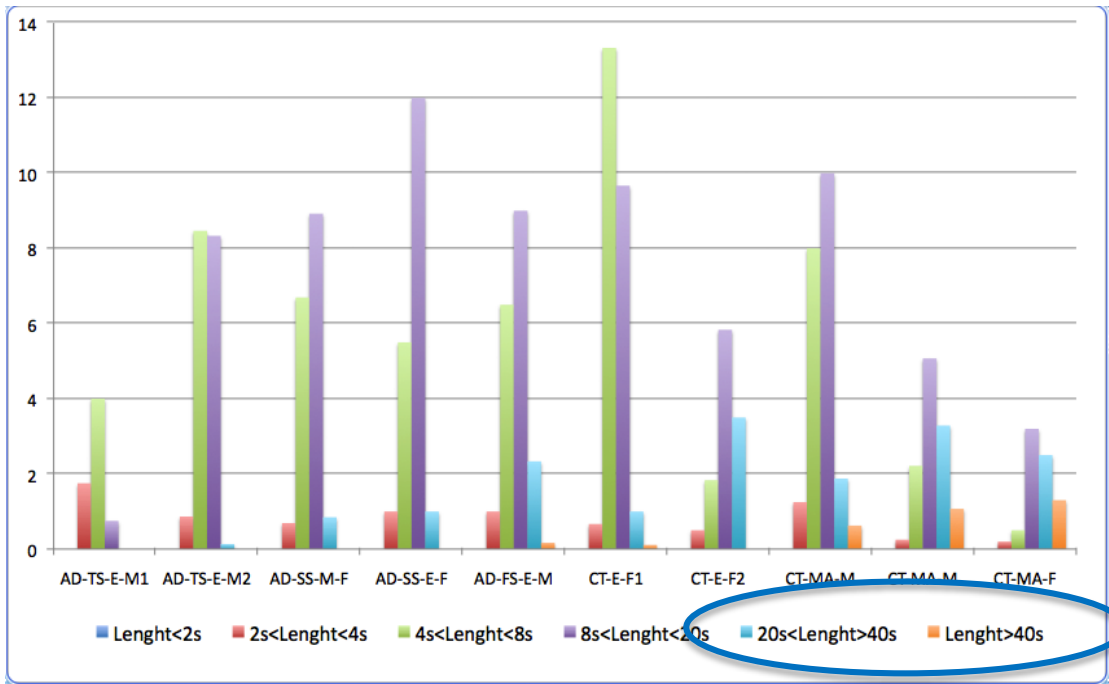## Research Group on Digital Technologies - Vic Brain Unit

Engineering

Speech for AD detection

Percentage of voiced frames in the spontaneous speech over segments

The analysis shows that subjects with AD tend to **decrease** the number of voiced segments

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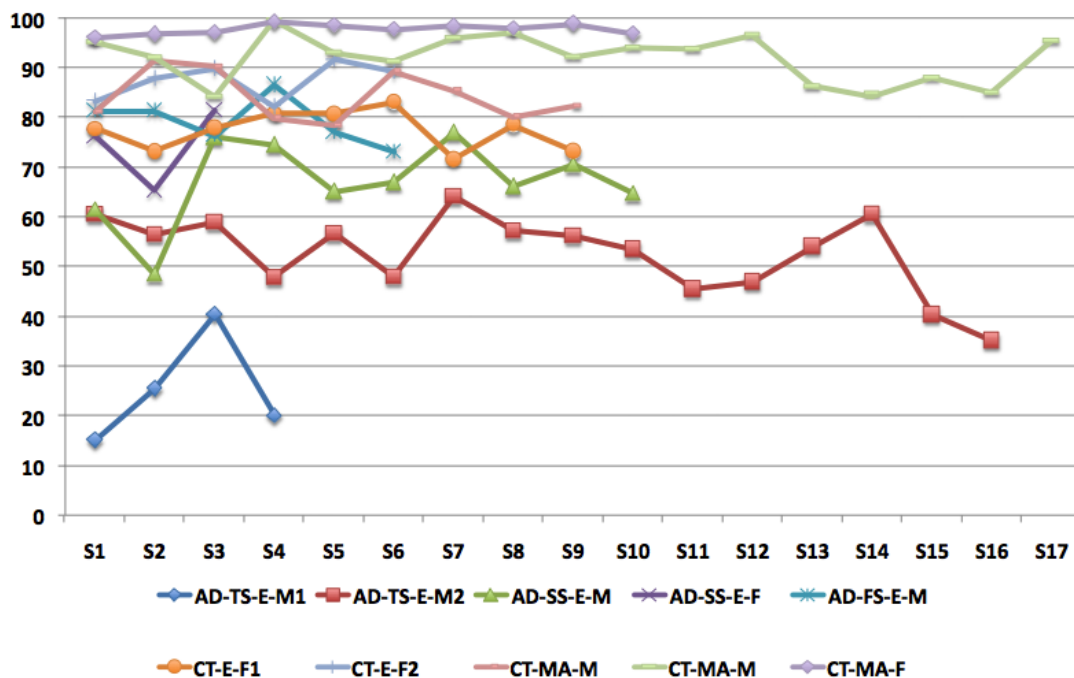
Engineering

Speech for AD detection

Histogram of voiced segments according to the segment length

Subjects with AD tend to **decrease** the **length** of **voiced segments**

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Engineering

Speech for AD detection
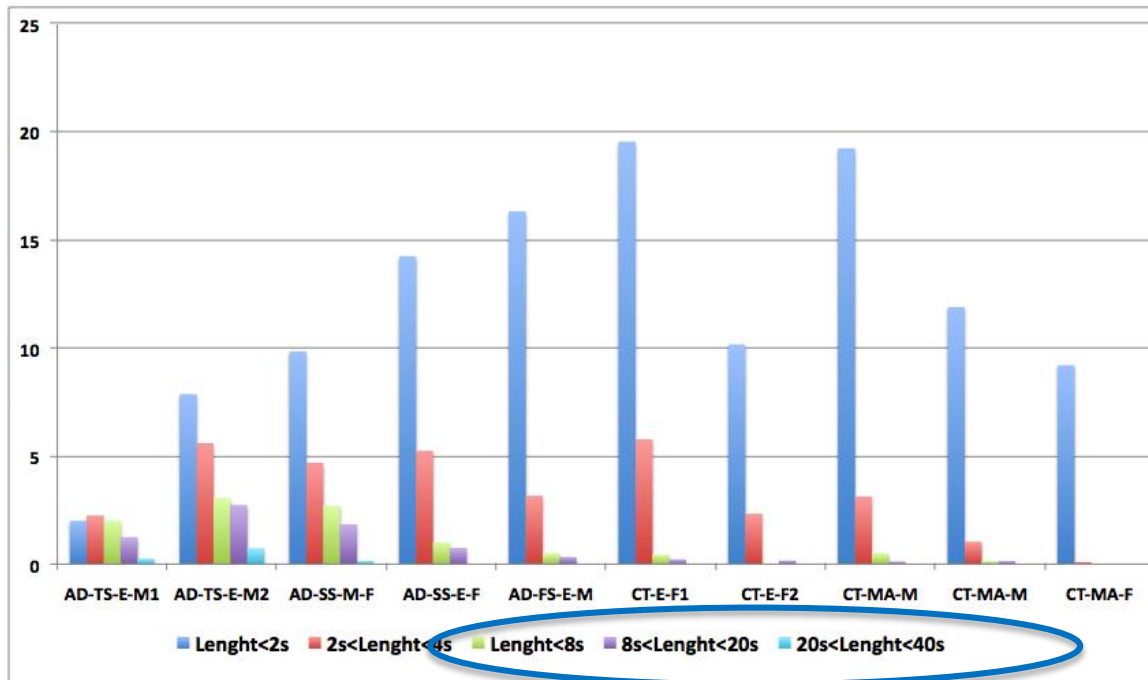
Histogram of unvoiced segments according to the segment length

Subjects with AD tend to **increase** the **length** of **unvoiced segment**

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Engineering

Speech for AD detection

Subjects with AD showed:

- A **decreasing slope** in the % of voiced frames of their spontaneous speech.

- A **tendency to use more shorter voiced segments and long unvoiced segments**.

- Their speech is **fluent only for short periods of time** and segments longer than10 seconds seldom appear in their spontaneous speech.
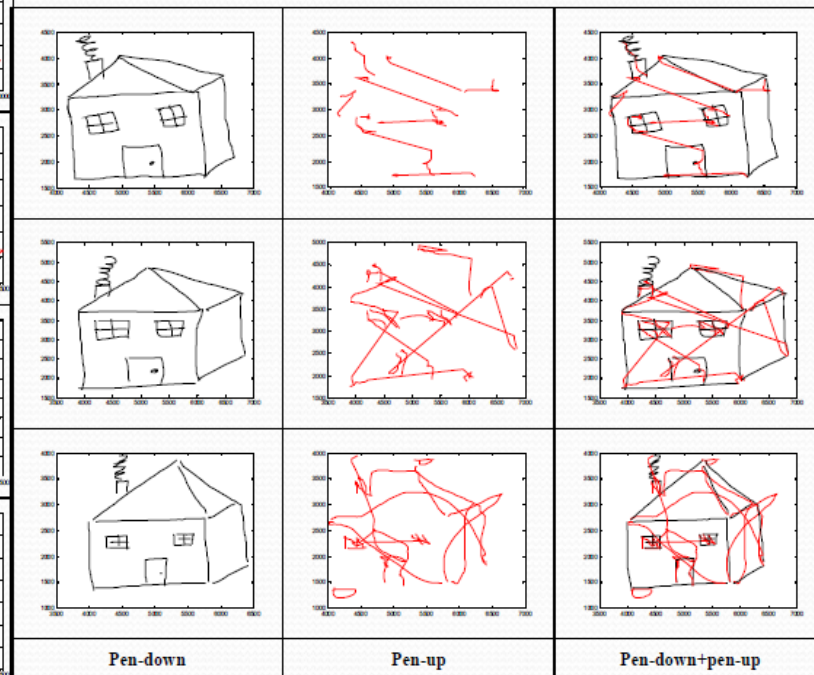
Engineering

Handwriting analysis
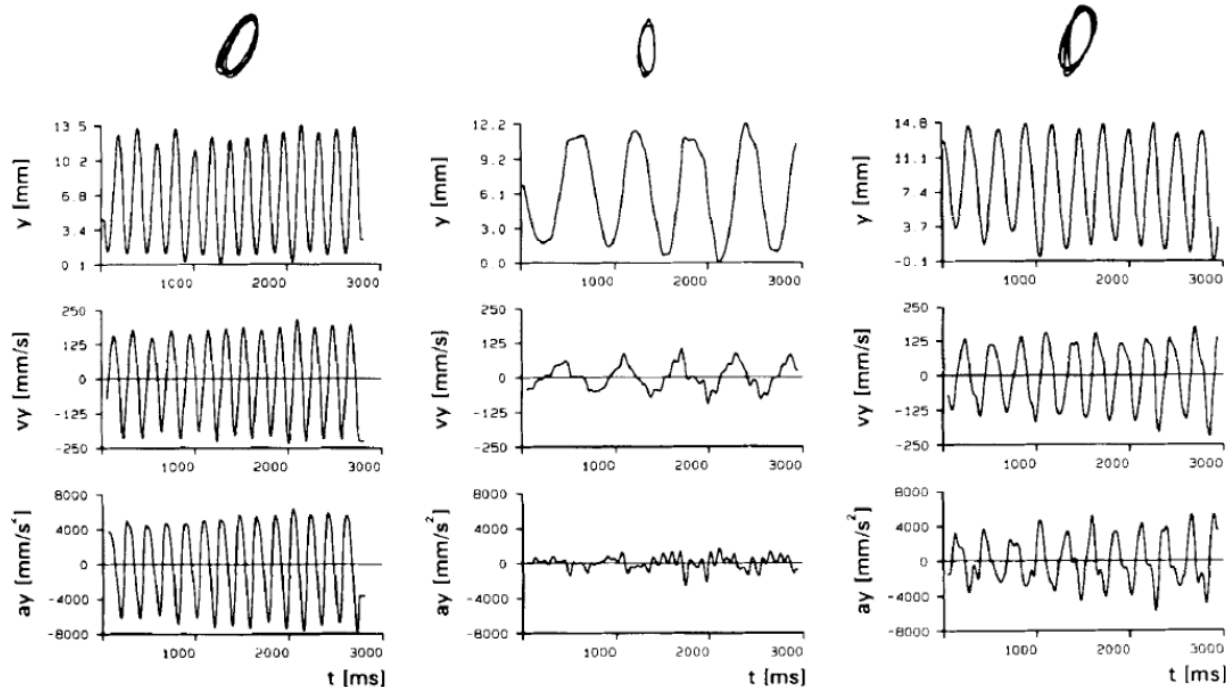
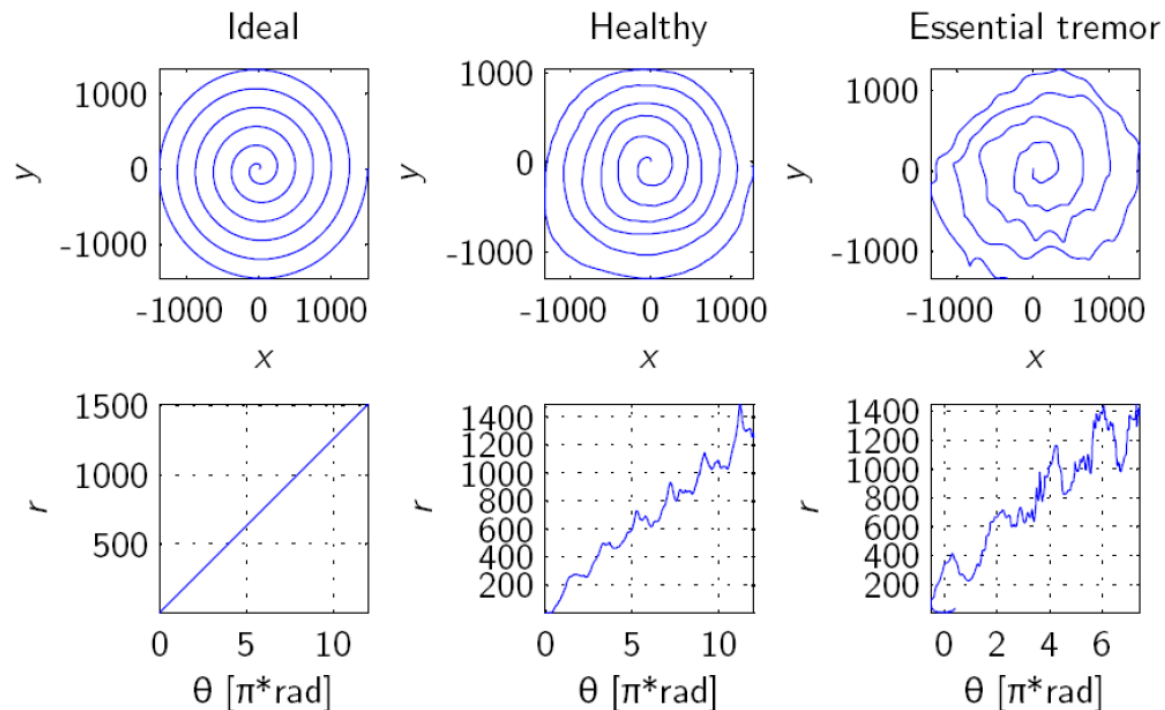## Research Group on Digital Technologies - Vic Brain Unit

Engineering

Handwriting analysis

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Engineering

Handwriting analysis

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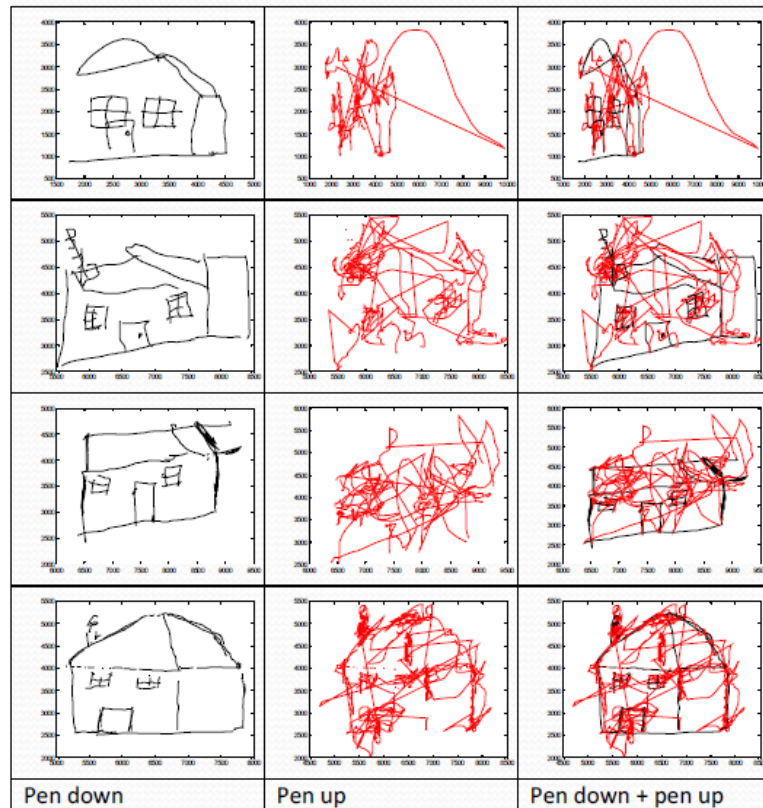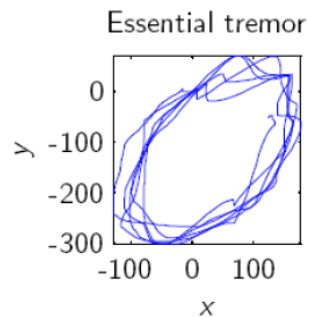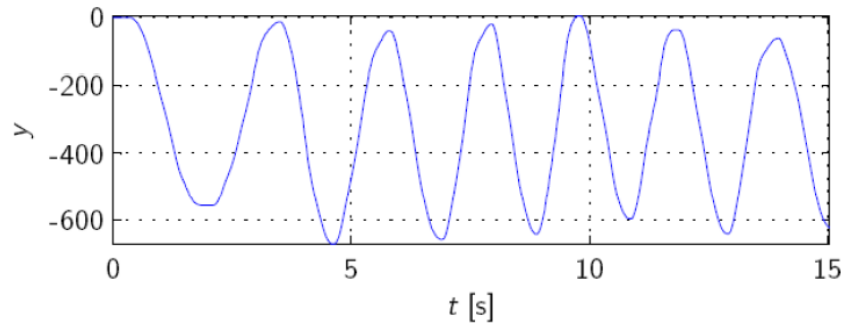
Engineering

Handwriting analysis
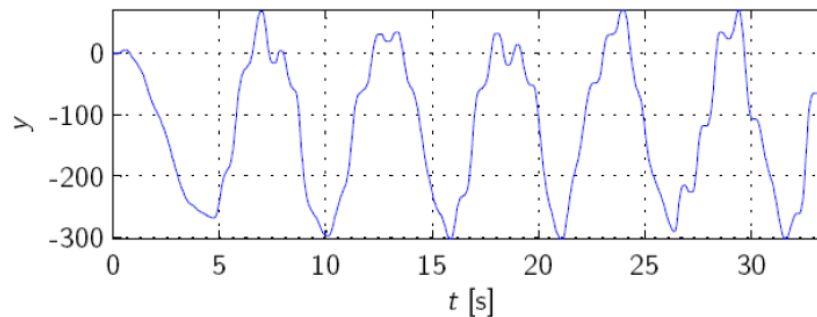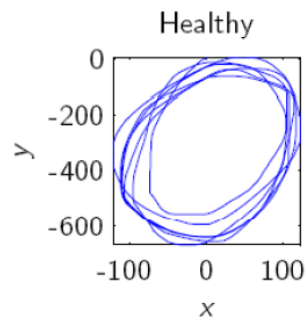
Thank you!

jordi.sole@uvic.cat

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