

Deusto eVIDA
Research group



*Pursuing its innovative
activities in the sphere of
health and wellbeing*



HEALTH



- Pathology analysis
- Diagnostic support
- Paradigms programming



- Neuroimage processing
- SPM
- FSL
- Graph Theory
- SPSS
- Matlab



- Children with dyslexia
- People with migraine
- Other pathologies



Services



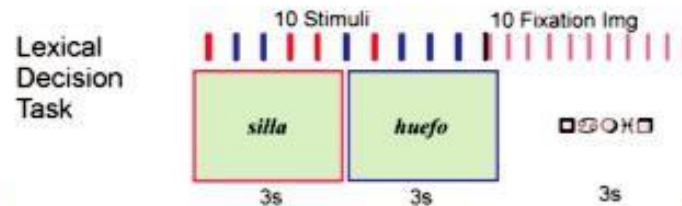
Technology



Collective

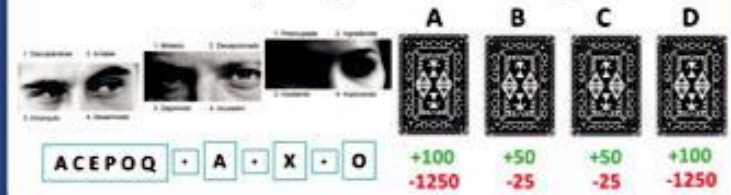
Dyslexic

Brain dyslexic children may have different circuit for reading.



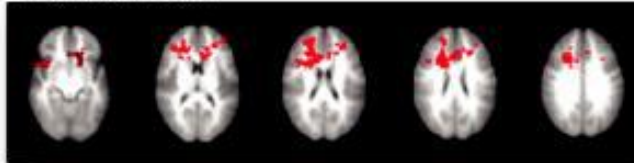
Migraine

Evaluating the impact of drug abuse in people with migraine.

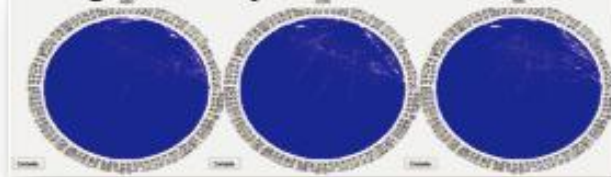


Results

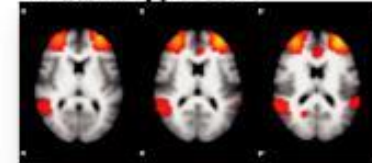
Functional



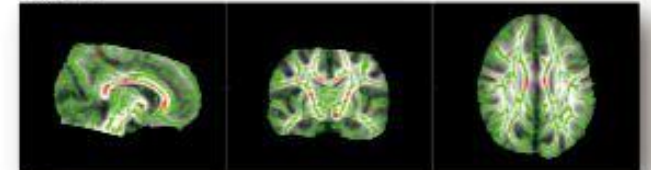
Graph theory



Resting state



DTI



- Mind-machine interface
- Periodic activity detection
- Epileptic seizure analysis

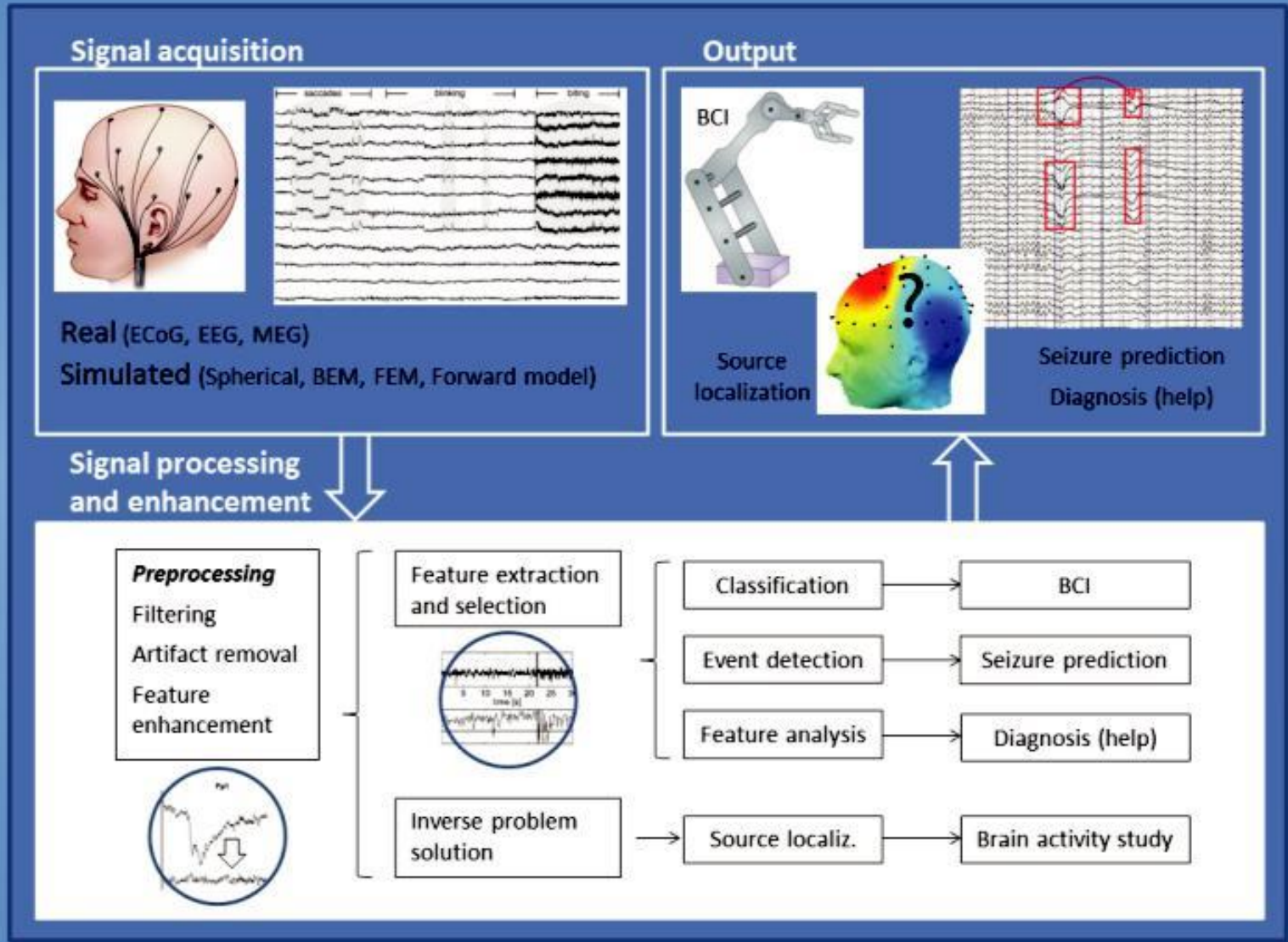
- Blind source separation, filtering, regression
- Classifiers
- Matlab (EEGlab)

- Children with ADHD
- Elderly
- Epileptic patients
- General population

Services

Technology

Collective



- Diagnosis of melanoma
- Lung nodule detection
- Articulary description
- Vocal cords characterization
- Pressure ulcer monitoring



- 2D and 3D image processing advanced techniques
- Datamining / Classifiers
- Java / Matlab



- Suspicious skin moles
- Lung cancer
- Articulary problems
- ENT pathologies
- Elderly people



Services

Technology

Collective

Dermoscopy images

Diagnosis of melanoma: analysis of patterns and ABCD Rule



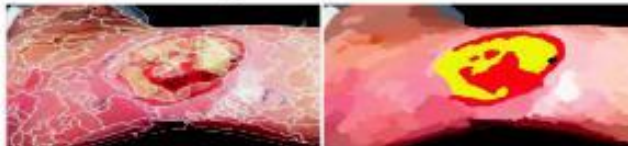
Stroboscopy images

Vocal cords: segmentation and characterization



Pressure ulcer images

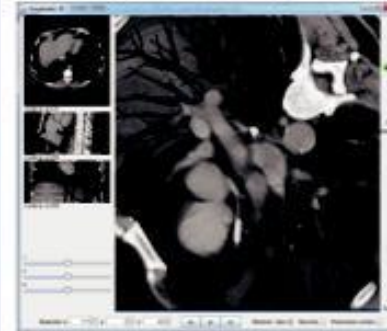
Pressure ulcers: calculation of measures and monitoring



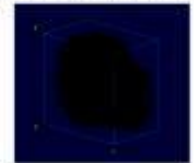
MRI images

Lung

2D and 3D processing



Nodule detection



Patient monitoring

Step	No.	Source	Destination	Accession
1	1001	0170-070	100-001	1000-070
2	1001	0204	100	1000
3	1001	0100-070	100-001	1000-070
4	1001	0400-020	077-020	000-020
5	1001	0100	000	000
6	1001	0100	000	000
7	1001	0100	000	000

Articulary system

2D and 3D processing



3D segmentation



Articulary description

Parameter	Val	Image No.	Image File	Measurement	Orthogonal Height/area	Angle(deg)	Length(mm)	Perim (mm)	Area(mm ²)
CB	0	0	1120700	Polygonal			142.1000	524.700000	
CB	0	0	1120701	Polygonal			142.716000	420.500000	
CB	0	0	1120702	Polygonal			144.172000	482.010000	
CB	0	0	1120703	Polygonal			142.300000	459.417000	
CB	0	0	1120704	Polygonal			142.670000	500.000000	
CB	0	0	1120705	Polygonal			144.000000	404.300000	
CB	0	0	1120706	Polygonal			130.271000	400.700000	
CB	0	0	1120707	Polygonal			140.100000	417.200000	
CB	0	0	1120708	Polygonal			141.240000	444.270000	
CB	0	0	1120709	Polygonal			142.000000	434.000000	

- Pathology detection
- Enhancement/Noise reduction
- Mathematical Model



- Matlab
- MDVP
- Recording devices



- Laryngectomees
- Mobile coder researchers



Services

Technology

Collective

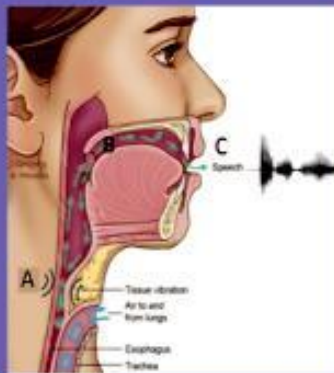
Introduction

The Oesophageal Speech

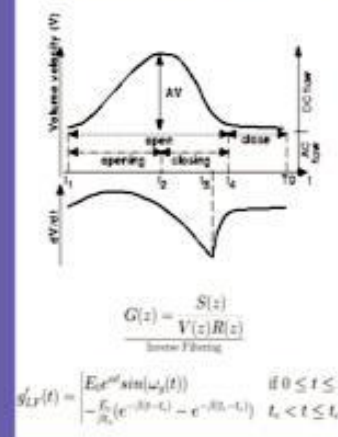
- Speech Production method involves oscillation of esophagus
- in contrast to traditional laryngeal speech
- which involves oscillation of the vocal folds
- Production Procedures
- air is injected into the upper esophagus and then released in a controlled manner to create sound for speech

Objectives

- Oesophageal Speech Database (OSD)
- Mathematical Model for Oesophageal Speech source/filter decomposition
- Oesophageal Speech Toolbox (Matlab)
 - Source Modification
 - Non-Glottal Closure Initiat (NGCI)
 - Non-Glottal Opening Initiat (NGOI)
 - Fractional Frequency Convexion (F_c)
 - Filter Modification
 - Formants Modification (F_1, F_2, F_3)
 - Poles Stabilization/Modification
 - Kalman Filtering
 - Subband Kalman Filtering
 - Modulation Domain Kalman Filtering
 - Adaptive Gain Equalizer
 - Wavelet transformation etc.



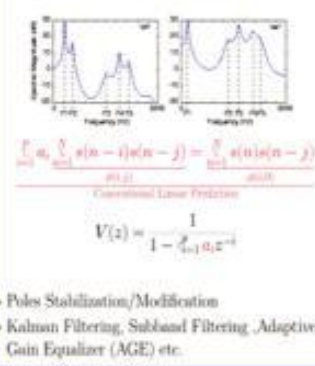
A). Glottis Flow (source)



Lips Radiation

$$R(z) = 1 - \alpha z^{-1}$$

B). Vocal Tract



- Poles Stabilization/Modification
- Kalman Filtering, Subband Filtering, Adaptive Gain Equalizer (AGE) etc.

C). Speech Signal

$$\frac{s(t)}{\text{speech}} = \frac{g(t)}{\text{source}} * \frac{v(t)}{\text{vocal tract}} * \frac{r(t)}{\text{lips radiation}}$$

$$S(z) = G(z)V(z)R(z)$$

Methods

- Kalman Filtering, Subband Kalman Filtering
- Modulation domain, Wavelets
- Adaptive Gain Equalizer

References

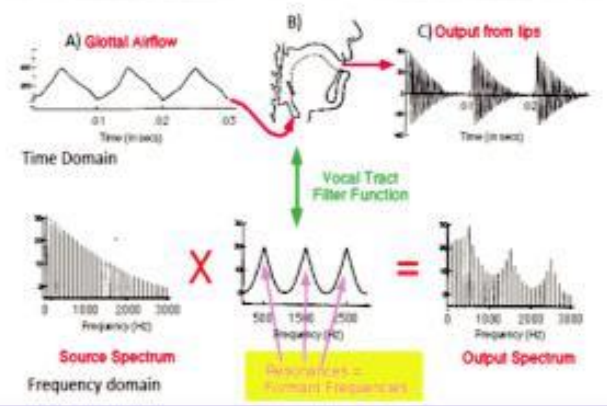
- [1] Marmen A, Begins G Z, Ben B, and Amia M. Oesophageal voice harmonic to noise ratio enhancement over neural networks using kalman-osc. In *Advances in Computational Intelligence*. 2011.
- [2] Raman I, B Garcia Z, S. Mohammad, and L. Demy. Subband modulator kalman filtering for signals channel speech enhancement. In *ICASSP*. 2013.
- [3] O.R. Ben, B. Garcia, and Z. M. Amia. New approach for oesophageal speech enhancement. *ISSPA*. 2010.
- [4] R. Ishaq and B. Garcia Z. Oesophageal speech enhancement using modified voiced source. In *ISNPT*. 2013.
- [5] Raman I and Begins G Z. Adaptive gain equalizer for improvement of oesophageal speech. In *ISNPT*. 2012.

Enhanced Speech



Quality Indicators

- Harmonic to Noise Ratio (HNR), Harmonic Richness Factor (HRF), Jitter, Shimmer, H2-H1 difference, Normalized Amplitude Quotient (NAQ)



- Adaptive Intelligent Therapy
- Gamification to boost user engagement

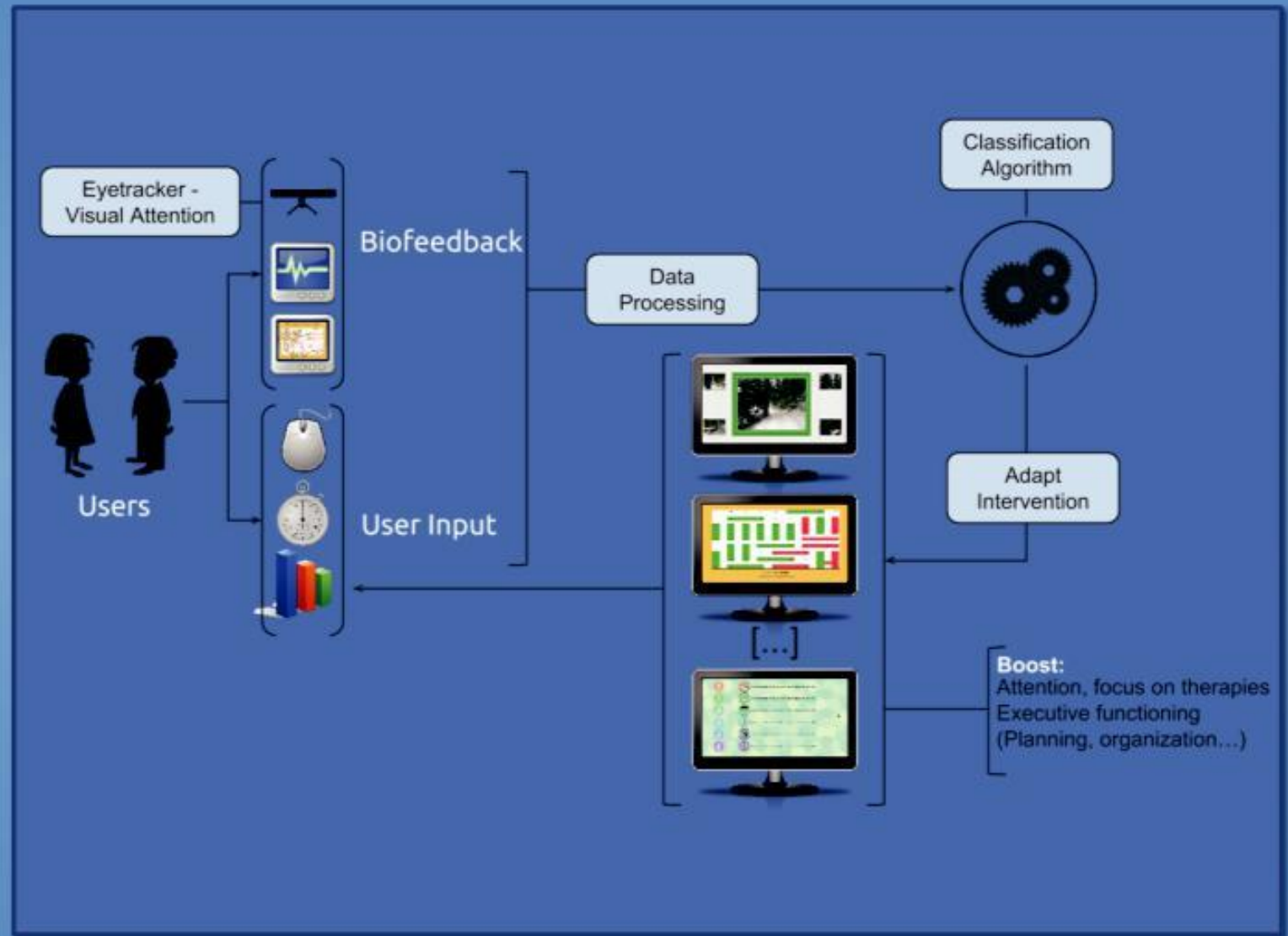
- Biofeedback
- Artificial Intelligence

- Children with ADHD (6 – 12 years old)
- Children with learning problems

Services

Technology

Collective



Serious Games



WELLBEING



- Healthy leisure activities
- Physical and cognitive rehabilitation

- Kinect Sensor
- Unity 3D Game Engine

- Elderly People
- Nursing Homes
- Caregivers

Services

Technology

Collective



Users → Kinect Sensor → PC

Physical Rehabilitation

Cognitive Rehabilitation

User Playing & Rewards

- Cognitive Rehabilitation
- Daily habits training
- Emotion control

- iPad
- Web platform

- Elderly people
- Children with Intellectual Disability
- Teenagers

Services

Technology

Collective



- Gait analysis
- Biomedical signals monitoring
- Rehabilitation
- TV Care



- Inertial, pressure, bending, ultrasound
- Biomedical sensors
- Robot: Lego NXT, Teensy, iOS
- BeagleBoard



- Elderly
- Chronic



Services

Technology

Collective

Gait analysis



- Shoe
- Insole

Biomedical signals monitoring



Fluorescence reader



ECG, respiration

- ECG, EMG, Oximeter...
- Fluorescence reader
- Textile

Rehabilitation



Alecsa



Physical



Cognitive

TV Care



Set Top Box:

- TV
- Videocalls
- Sensors

Autism Spectrum Disorder classifier using Adapted Games

- Adapted games for early detection of Autism Spectrum Disorder (ASD)
- Pattern detection

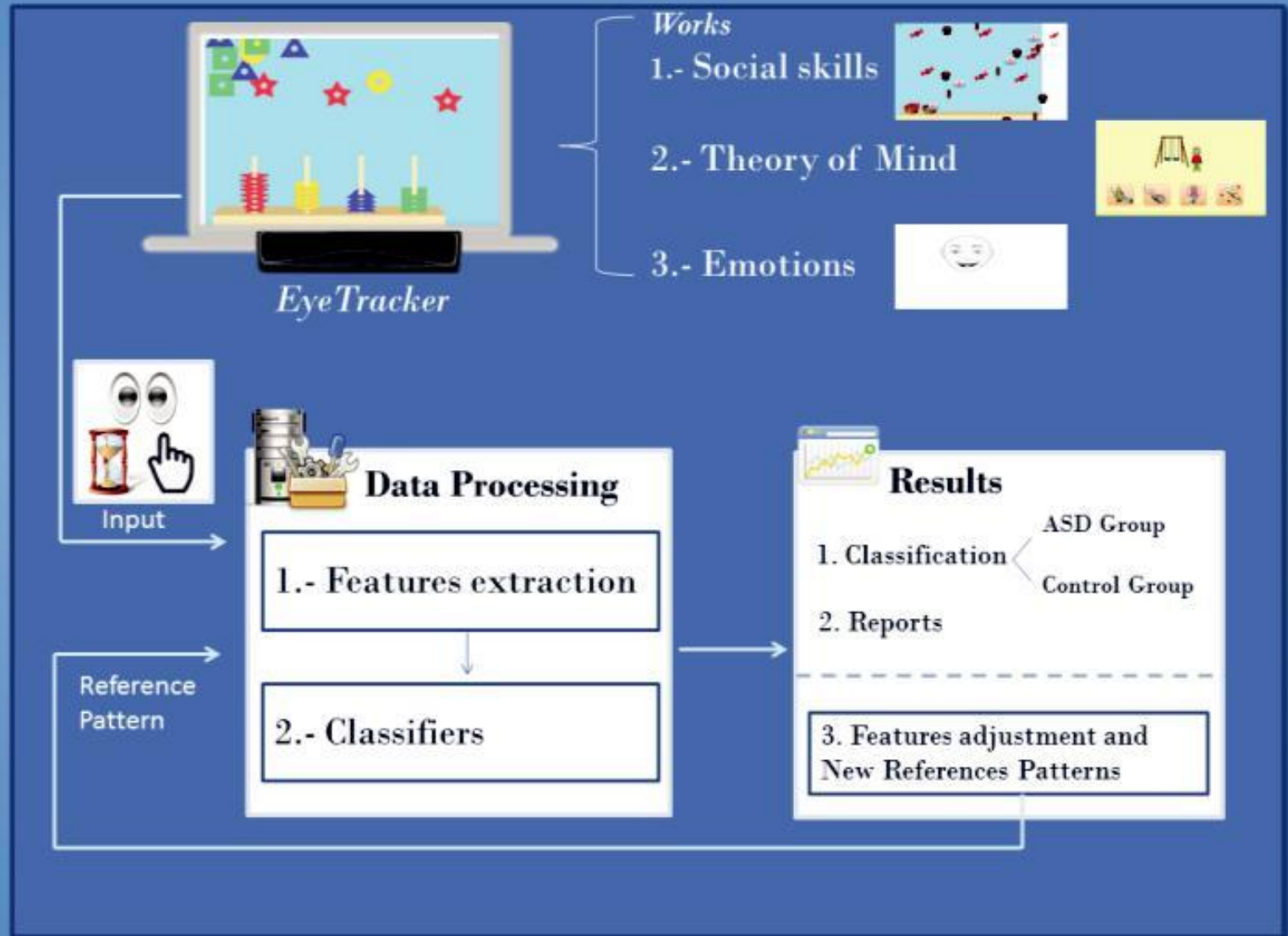
- EyeTracking
- Artificial intelligence
 - Data Mining
 - Classifier
- SPSS, WEKA

- Children with autism (3-8 years old)

Services

Technology

Collective



Serious Games

- Supervised telecare
- Patients' Monitoring
- Medical Parameters Storage



- Web
- API
- Web Services
- DataBases



- Elderly people
- Multiple Sclerosis
- Children (autism, dyslexia)
- Down Syndrome
- Professionals



- 👤 Services
- ⚙️ Technology
- 👥 Collective



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