



Università degli Studi di Milano Bicocca

Scuola di Scienze

Dipartimento di Informatica, Sistemistica e Comunicazione

Corso di laurea in Informatica

Preprocessing e analisi di dati psicofisiologici nel contesto di un esperimento di psicologia cognitiva

Marco Pellegrino

Relatore: *Gasparini Francesca*

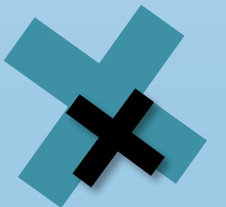


Esperimento

- + Esperimento eseguito dal dipartimento di sociologia*
- + I soggetti eseguono diversi task su device diversi
- + Task di Comprehension (CO)
- + Task di Information Seeking (IS)
- + I due device sono PC e Smartphone (PHONE)

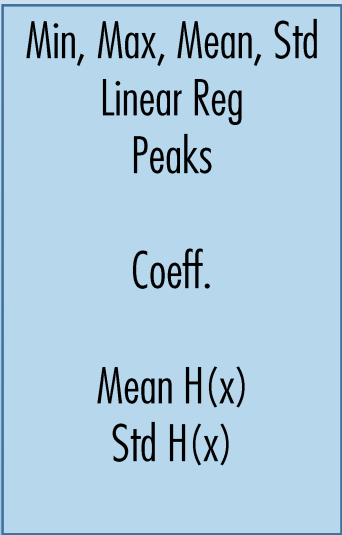
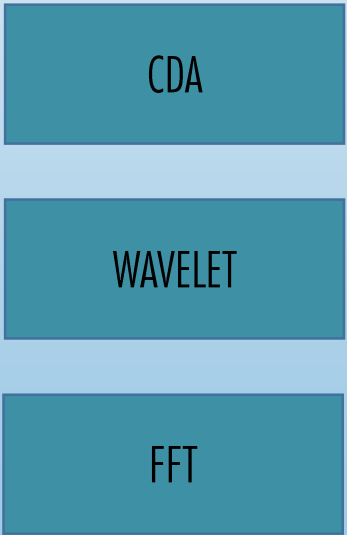
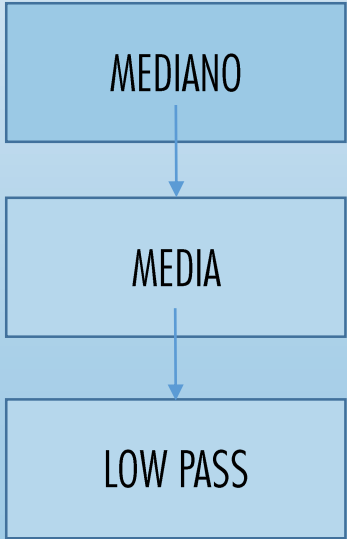
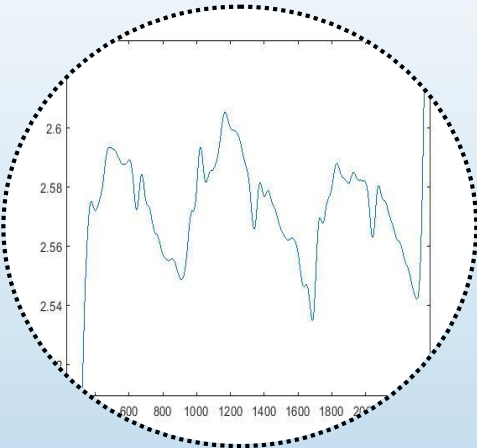


*(nome et al) dipartimento di sociologia

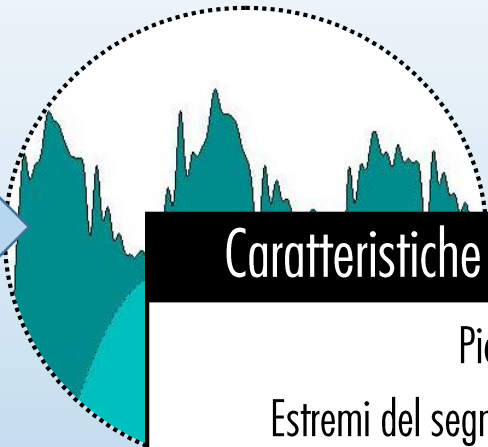


Pipeline

Segnale Originale



Classe Segnale



Caratteristiche

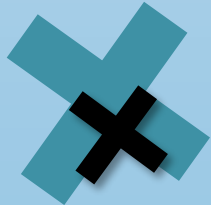
Picchi

Estremi del segnale

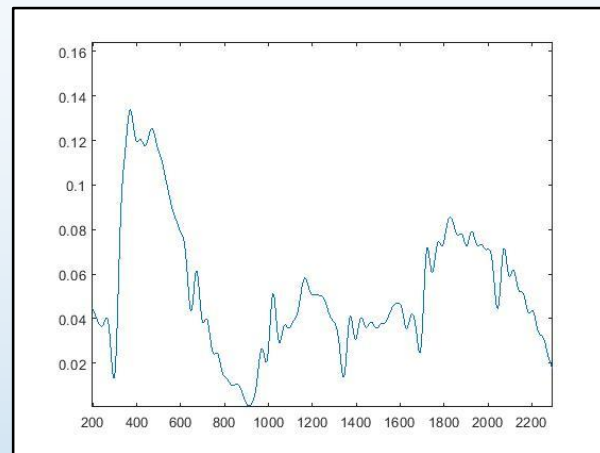
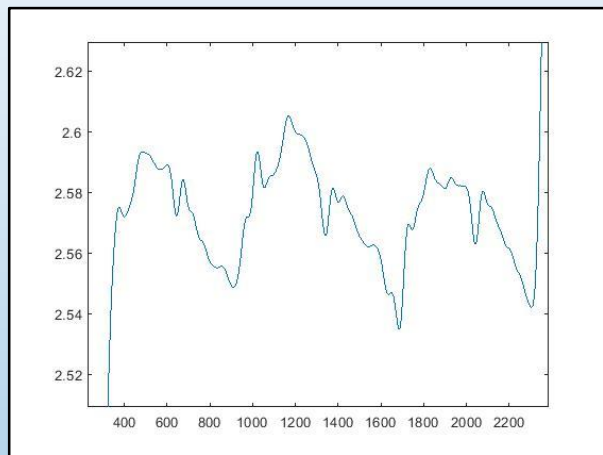
Media e deviazione

Spettri

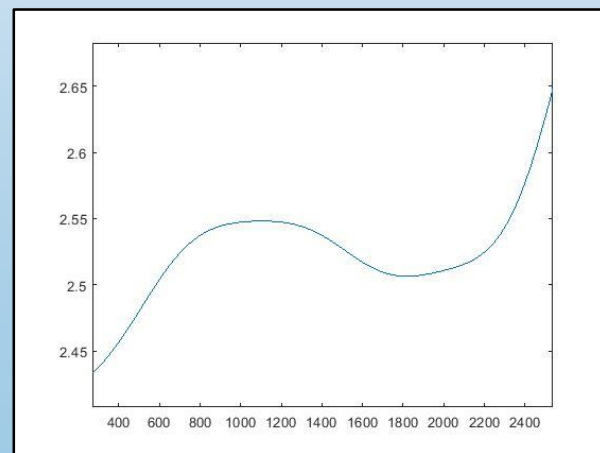
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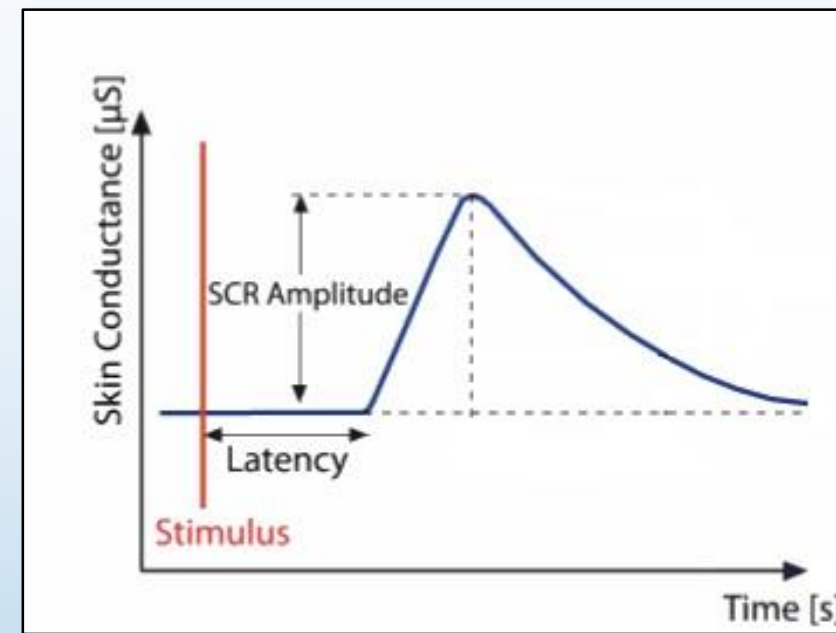
Galvanic Skin Response (GSR)



Componente fasica



Componente tonica



Picco ideale

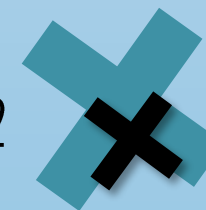


Latenza media dallo stimolo di 1,12 secondi

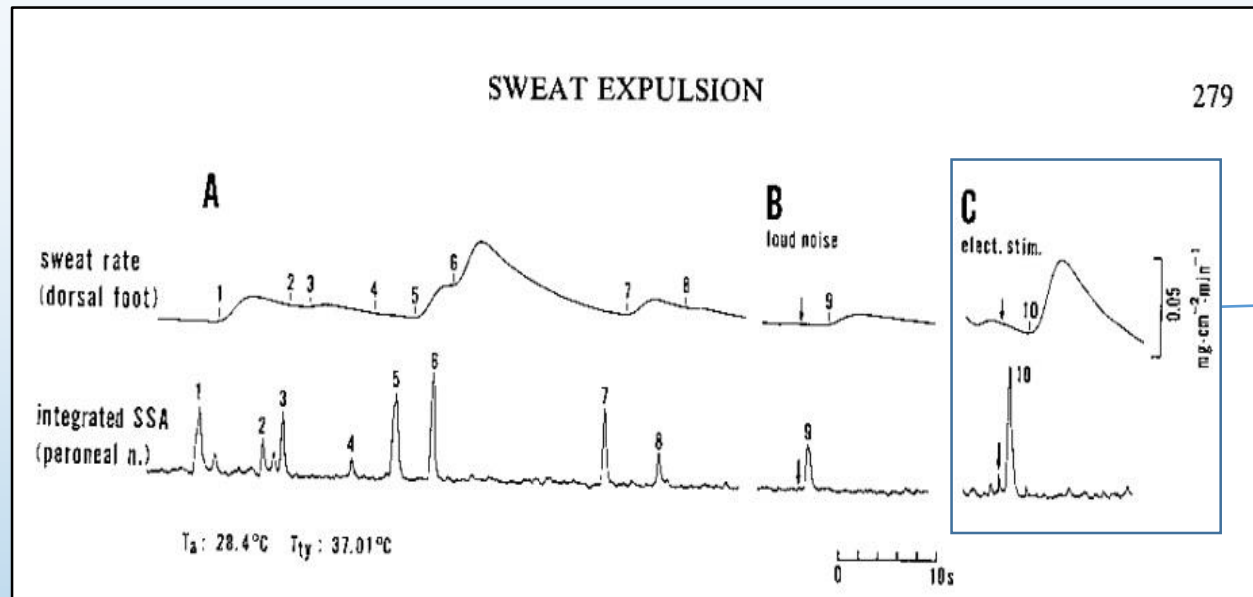


Presenza di eventi non specifici

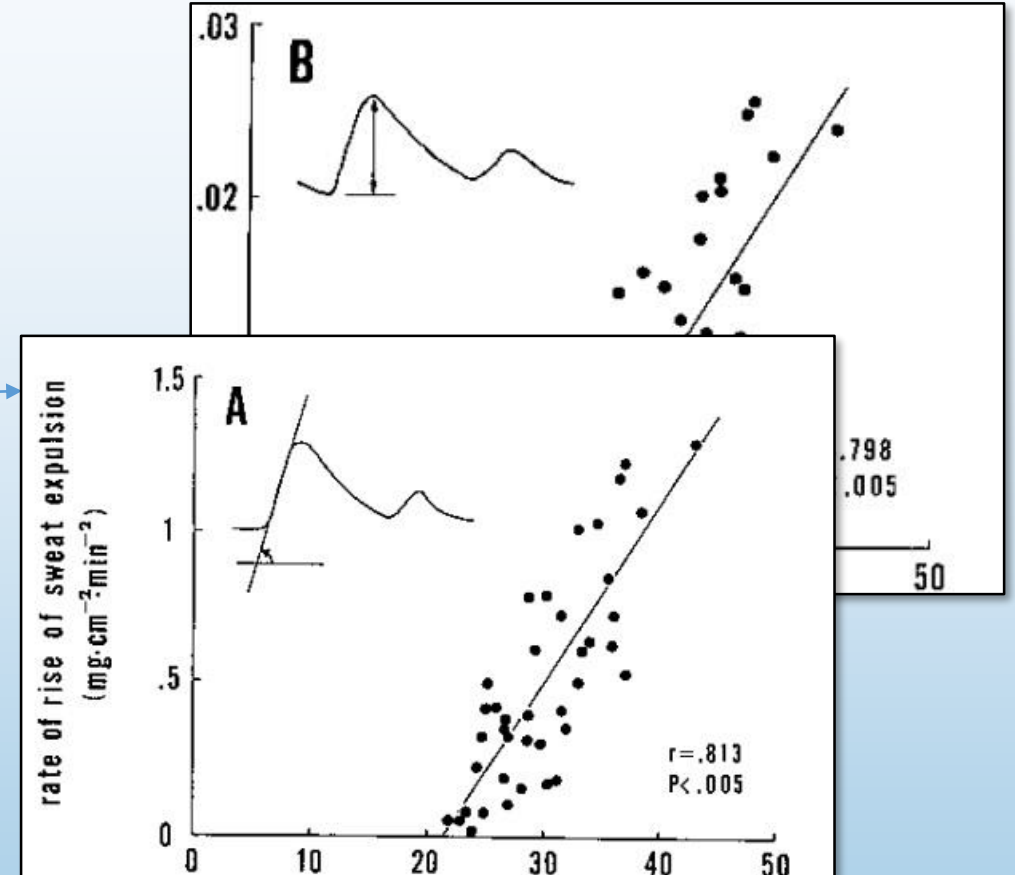
Slide 3 su 12



Fisiologia del segnale (1)

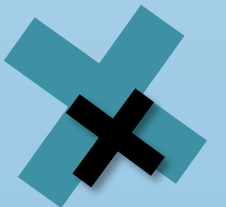


- ✚ Ampiezza tra 0.05 o 0.1 $\mu\text{Siemens}$, con frequenza di 0.62Hz
- ✚ Tra 1 e 3 secondi il tempo medio di un picco
- ✚ 1.2 Secondi il tempo di crescita medio

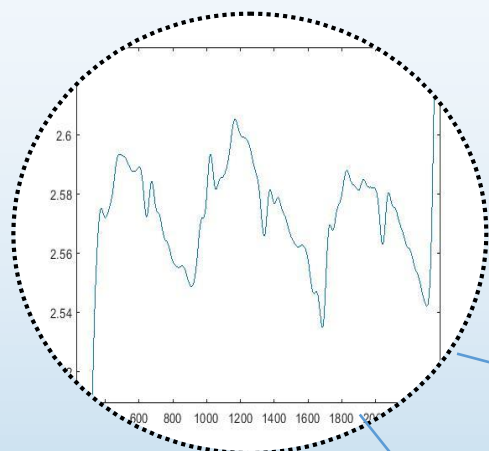


Fisiologia del segnale (2)

- + Velocità trasmissiva del sistema nervoso di 1.3 m/s per percorrere circa 1,1 metri.
- + Tempo medio di trasmissione del segnale 0,7 secondi
- + Frequenza massima segnale: 1,5 Hz



Pipeline per la pulizia del segnale

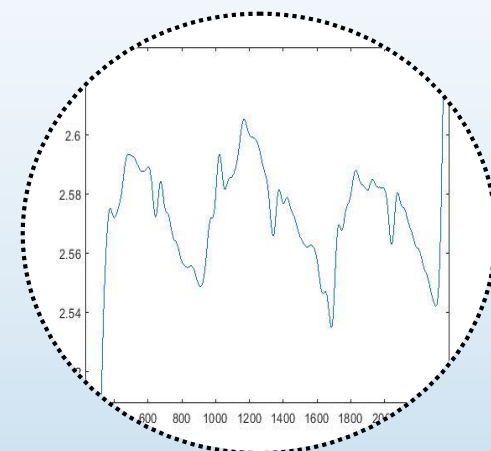


Raw

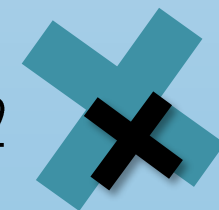
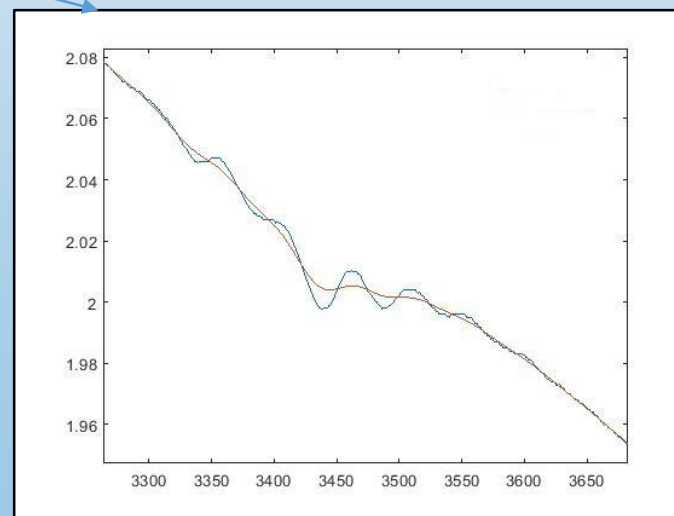
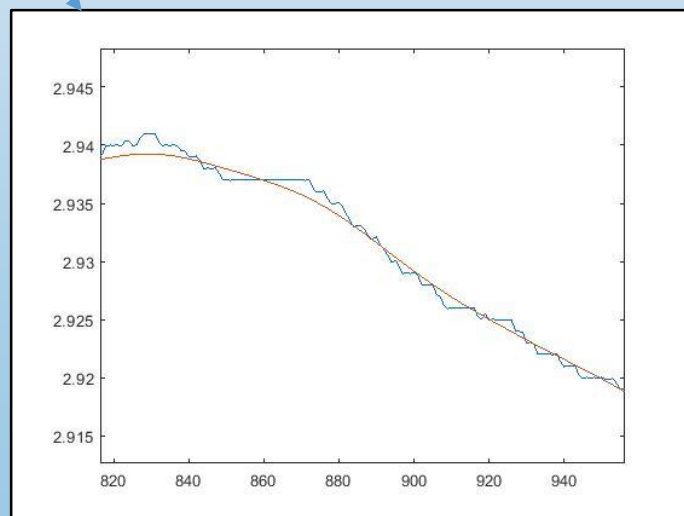
Mediano
0,5 sec

Media
1,1 sec

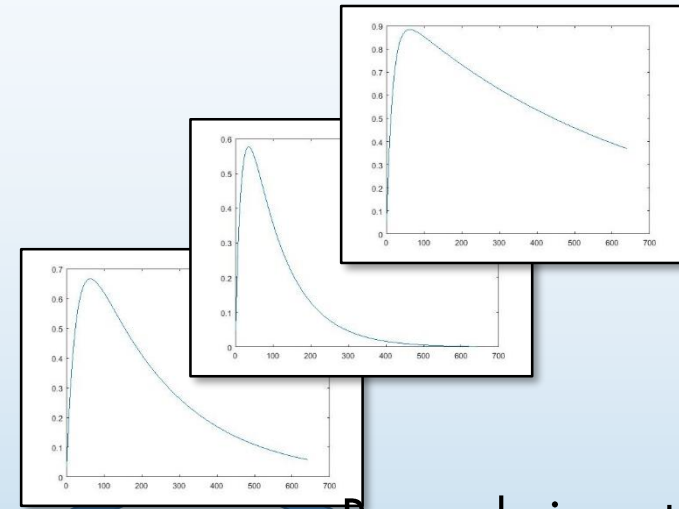
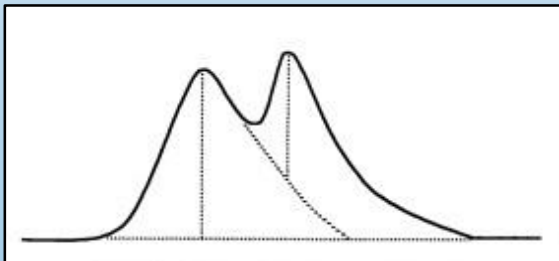
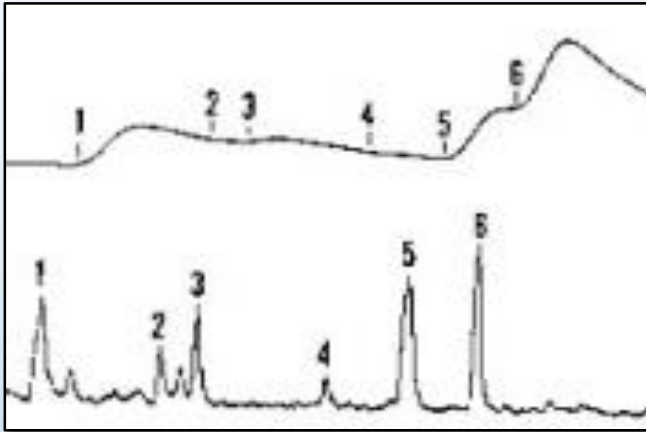
Low Pass
1,5 Hz



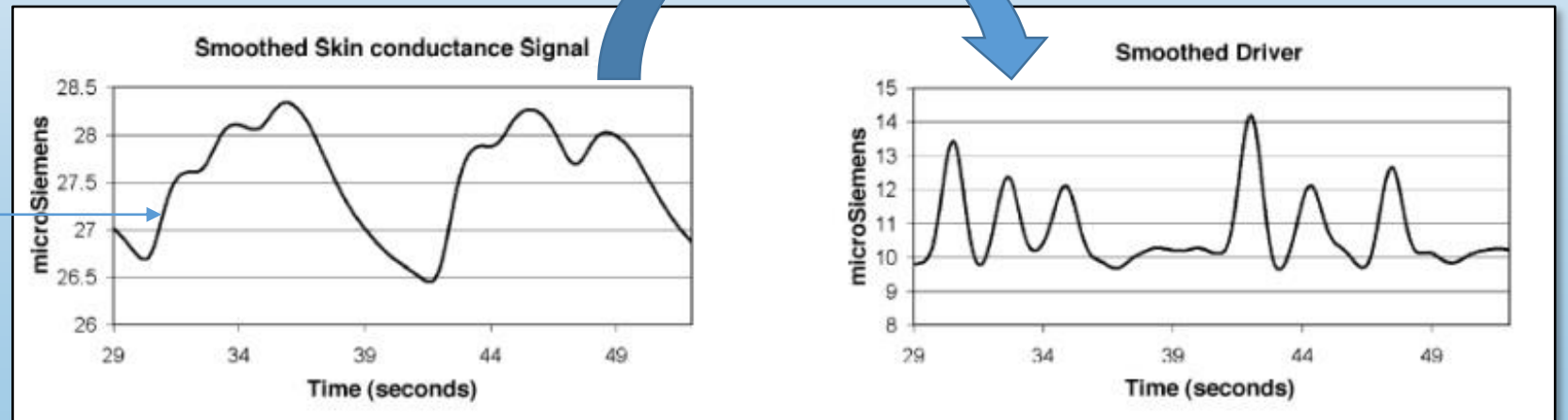
Cleaned Signal



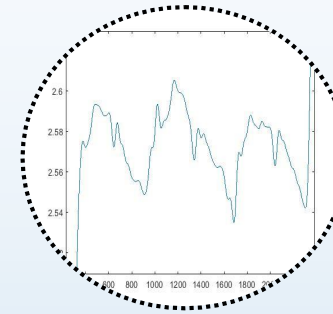
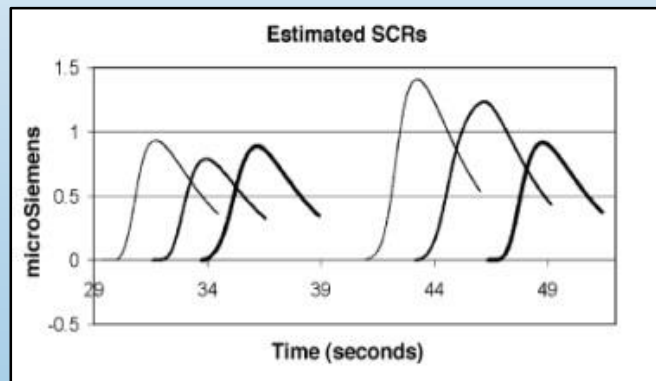
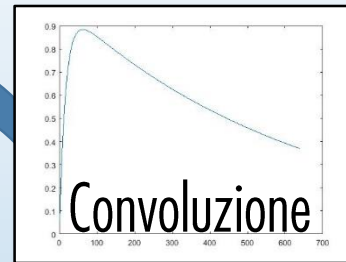
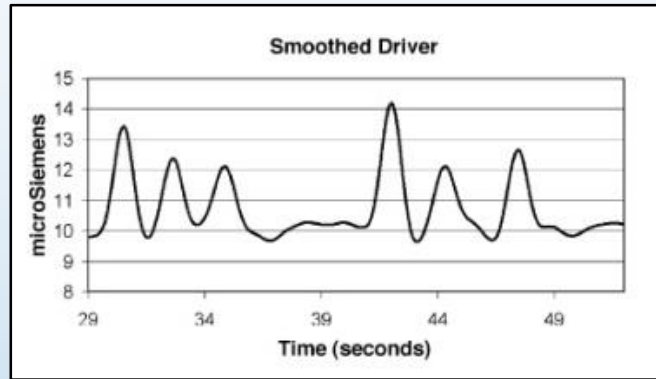
Estrazione caratteristiche: Continuous Decomposition Analysis (1)



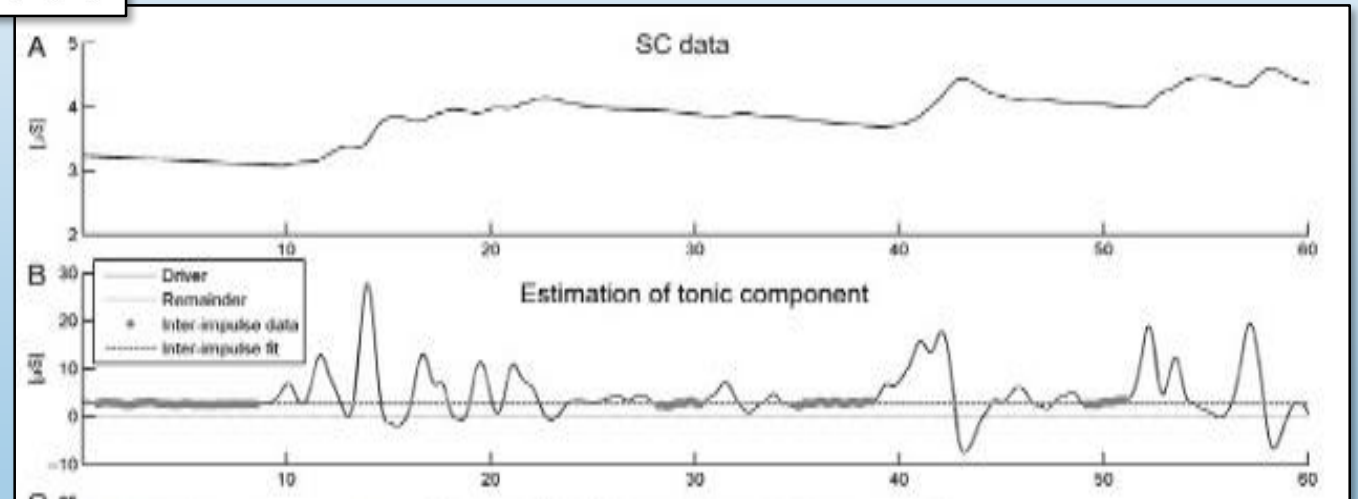
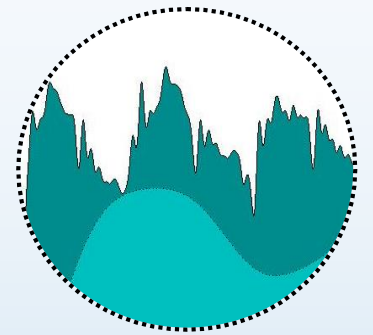
Deconvoluzione ottimizzata



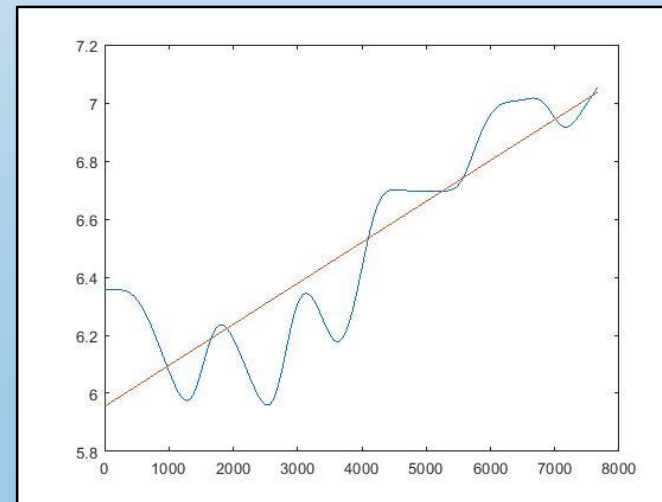
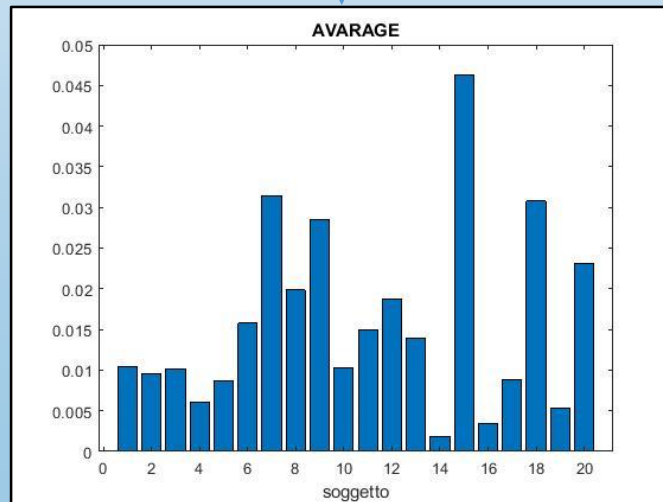
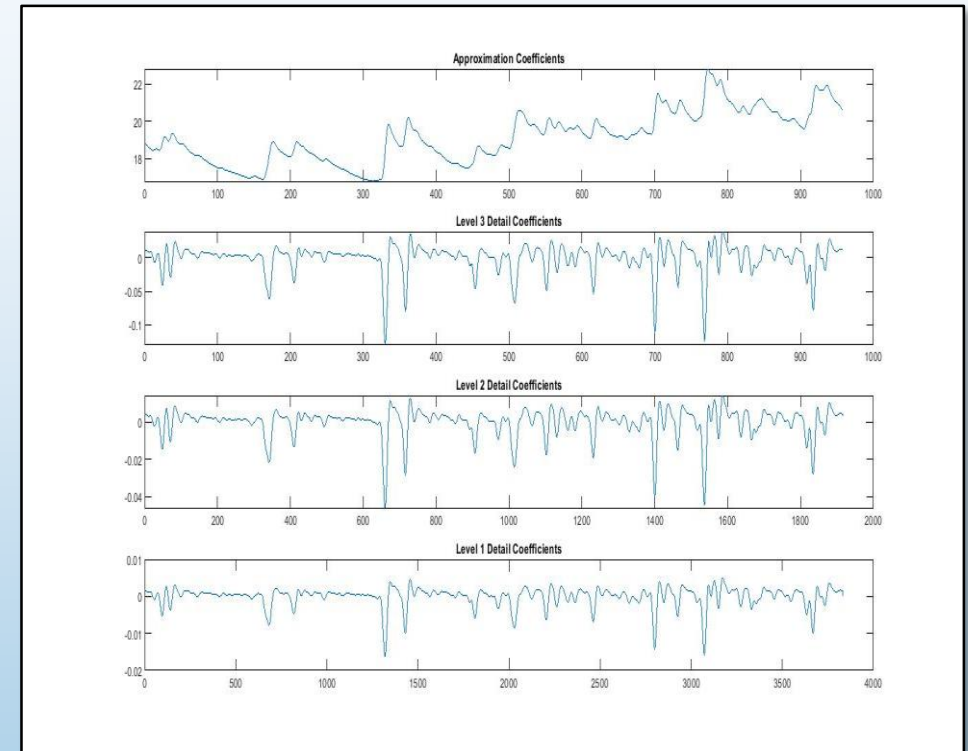
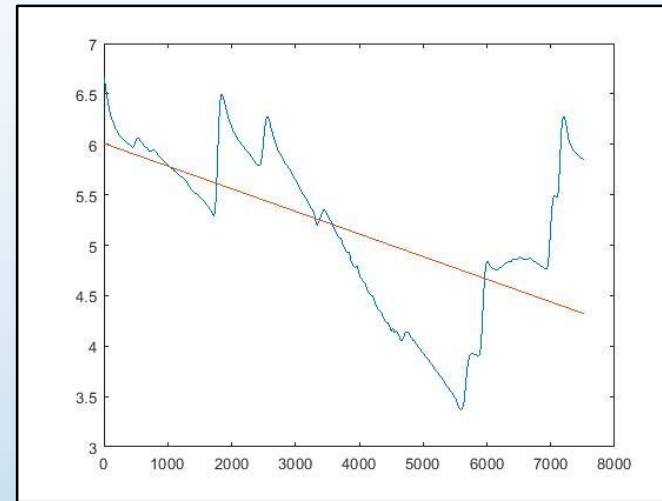
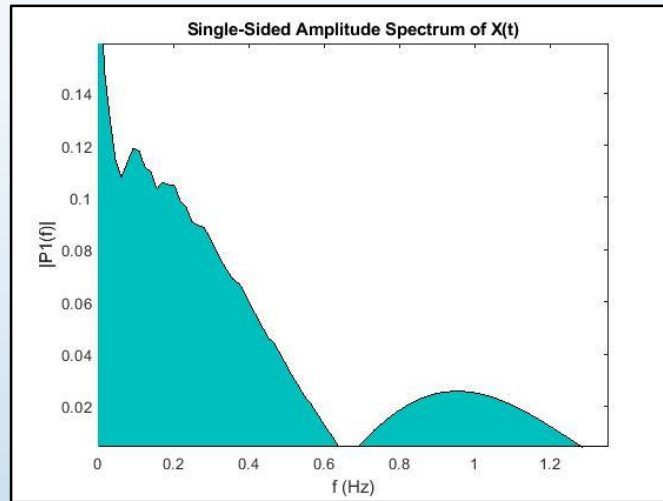
Estrazione caratteristiche: Continuous Decomposition Analysis (2)



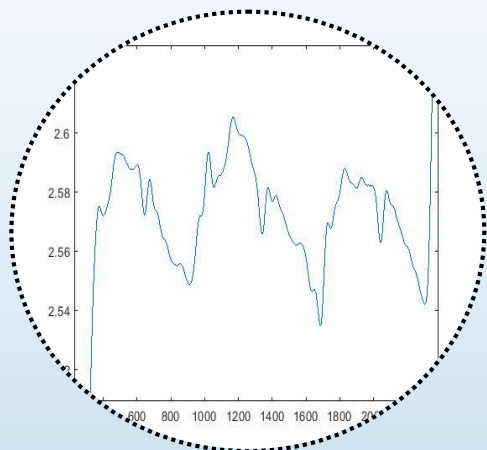
CDA



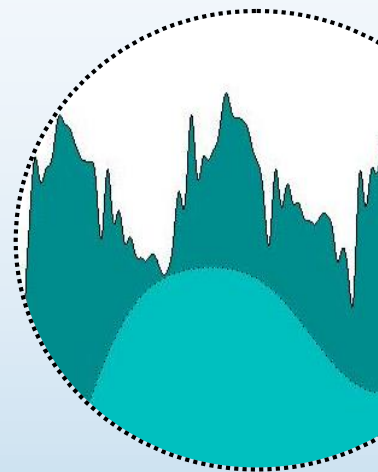
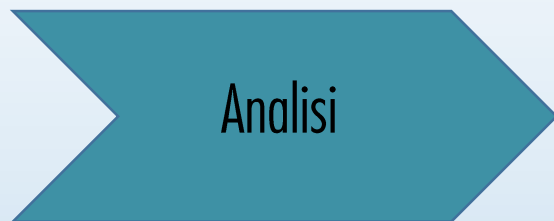
Estrazione caratteristiche: FFT, Linear fit, Wavelet



Inferenza statistica (1)



Raw



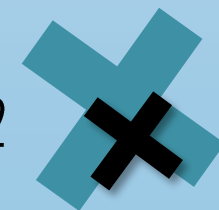
Classe Segnale

Caratteristiche

Picchi
Estremi del segnale
Media e deviazione
Spettri
[...]

✚ Normalizzazione rispetto al tempo

✚ Divisione in finestre della Baseline



Inferenza statistica (2)



Confronto ogni segnale di ogni soggetto



Differenza rispetto alla baseline



$$\frac{CO - BL}{BL} ; \frac{IS - BL}{BL}$$

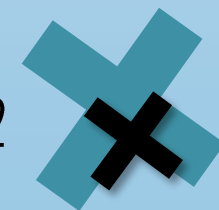


ANOVA

PHONE
Soggetto 1
Soggetto 2
Soggetto 3
[...]

VS

PC
Soggetto 1
Soggetto 2
Soggetto 3
[...]



Risultati

Confronto Normalizzato

PC %	Minimo	Massimo	Ampiezza media	Numero di attivazioni
CO - BL / BL	80	85	40	65
IS – BL / BL	85	95	40	75

PHONE %	Minimo	Massimo	Ampiezza media	Numero di attivazioni
CO – BL / BL	75	95	40	85
IS – BL / BL	80	100	40	90

ANOVA

	Minimo	Massimo	Ampiezza media	Numero di attivazioni
PHONE : CO VS IS	0.04	0.29	0.88	0.10
PC : CO VS IS	0.08	0.51	0.31	0.24



FINE PRESENTAZIONE