Sympathetic skin response analysis using exosomatic method, biomedical sensors and clustering technique

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- **The sympathetic skin response** (SSR) is a potential generated by skin sweat glands;
- GSR (skin conductance response or electrodermal response) is the phenomenon that the skin momentarily becomes a better conductor of electricity when either external or internal stimuli occur that are physiologically arousing (MIT definition).
- Galvanic skin response for monitoring the bioelectrical conductivity measured from the surface of the skin and reflecting change of the bioelectric properties.
- Based on GSR can be appreciate the skin moisture.

Skin bioelectrical conductivity = f(stress degree, diseases);
Skin conductance is in direct relation with skin moisture.
Skin moisture is influenced by heat dissipation mechanism from the body surface to the environment

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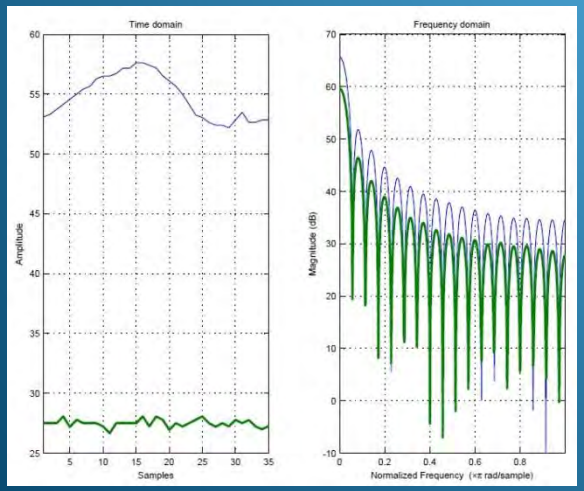
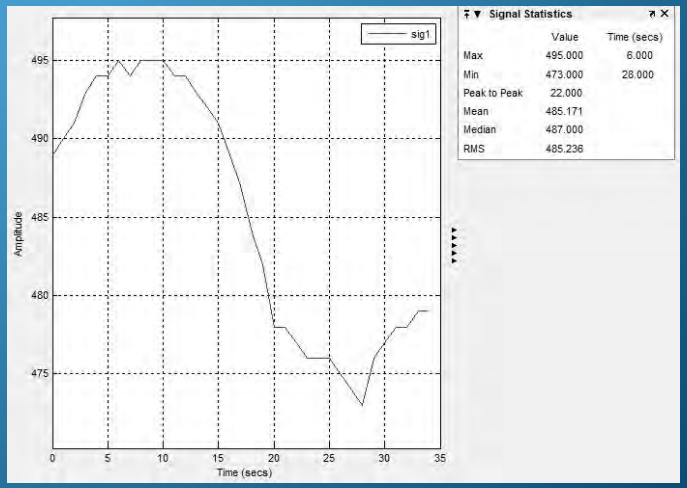
Experimental part:

-GSR sensor was integrated to a smart sensor system with MCP9700 temperature sensor integrated in ARDUINO ATmega328 board, based on a RISC microcontroller chip, sensors, a Bluetooth device and flexible electrodes.

-The tests were provided by setting the 500 milliseconds delay between analog readings. After ADC the numerical values for humidity and temperature were displayed on a data logger.

-The data obtained was used for signal processing in MATLAB





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$$\operatorname{cov}(humidity, temperature) = \begin{vmatrix} 3.4176 & 0.0212 \\ 0.0212 & 0.1035 \end{vmatrix}$$

The value 0.0212 is the-correlation coefficient for humidity and temperature vectors.

$$\operatorname{cov}_{1,2} = \operatorname{cov}_{2,1} = 0.0212 > 0$$

$$R_{humidity,temperature} = \begin{vmatrix} 1.0000 & 0.0356 \\ 0.0356 & 1.0000 \end{vmatrix}$$

$$R_{humidity,temperature}(1,2) = R_{humidity,temperature}(2,1) \neq 1$$

Because the covariance coefficient $\operatorname{cov}_{1,2} = \operatorname{cov}_{2,1} = 0.0212 \approx 0$, temperature and humidity are in direct proportionality report but are not in a strong dependence.

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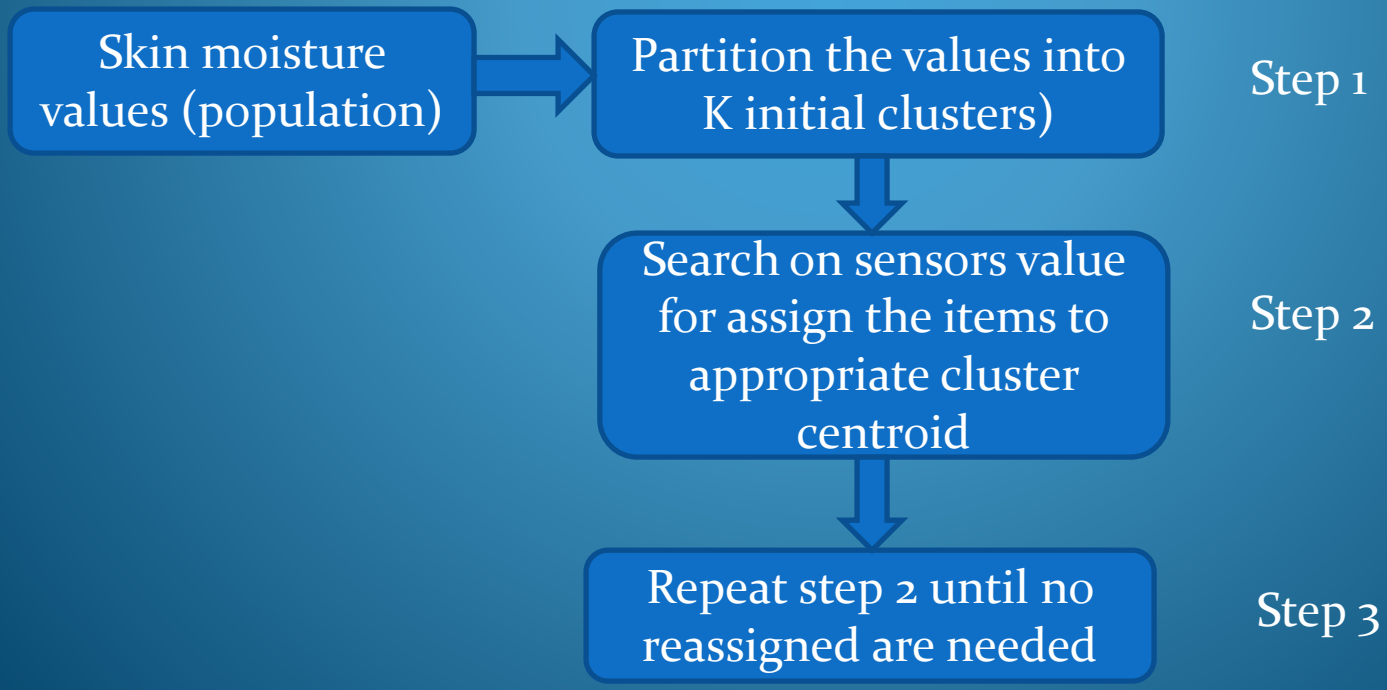
-The goal of the health parameters monitoring is to create a decision system;
➔sensors reading at 500 millisenods
➔can used multivariate analysis ➔ data mining➔ clustering techniques
➔ K-Means Procedure based on partitioning algorithm (each cluster is represented by the center of the cluster);



Big data predictive analytics for bioheat transfer modeling

Conclusions:

➔The analysis of biomedical signals is very important for disease behavior monitoring in case of patients with chronic diseases (diabetes) and for health condition monitoring (sport activities).

➔skin humidity allows the body to set the optimal temperature for disease conditions or environment conditions.

➔ Data clustering help in grouping the values and extract the diseases behavior by Parameters

➔The use of multivariate analysis decrease the time required for data classification and analysis;

➔By clustering the parameters are grouped in classes and this facilitate the searching and predictive modeling development;

Advantage K-Means:

• Simple, understandable

• items automatically assigned to clusters

Disadvantages:

-Is stopping at the local optimum

-Is sensitive to outliers values;

Thank you for your attention !