# University of Rome Tor Vergata Project List

## Project Work 1

**Title**

Statistical analysis of a dataset using multivariate probability estimation

**Tutor:**

Mauro De Sanctis

**Description**

Project main idea is to analyse the statistical properties of a set of data providing descriptive information. The dataset will be used for testing clustering algorithms.

The project should be carried out using a mathematical programming language (i.e. Matlab or Octave).

Good programming discipline should be followed when writing the Matlab-code. This means that the variable names should be logical, the code must be commented and it should be written in such a way that it is easy to follow and understand. Figures should have appropriate titles and axis labels and use of axis command is recommended (see help: title, xlabel, ylabel, axis).

**Expected results**

The software implementation should find a solution which minimizes the processing time a set of equivalent methods for data processing.

## Project Work 2

**Title**

Statistical classification on a dataset using multivariate probability estimation

**Tutor:**

Mauro De Sanctis

**Description**

Project main idea is to test classification algorithms using a statistical approach (i.e. Bayes or Entropy-based).

The project should be carried out using a mathematical programming language (i.e. Matlab or Octave).

Good programming discipline should be followed when writing the Matlab-code. This means that the variable names should be logical, the code must be commented and it should be written in such a way that it is easy to follow and understand. Figures should have appropriate titles and axis labels and use of axis command is recommended (see help: title, xlabel, ylabel, axis).

**Expected results**

The software implementation should find a solution which minimizes the processing time a set of equivalent methods for data processing.

# Project Work 3

**Title**

Development of a satellite smart gateway simulator for future High Throughput Satellite (HTS) systems.

**Tutor:**

Tommaso Rossi

**Description**

Project objective is to develop a smart gateway simulator for HTS systems. The goal is to test and optimize different smart gateways implementation strategies and system architectures. The simulator should include a realistic user traffic generator (for broadband satellite user access services) and should include the option to be fed by datasets coming from Q/V band satellite communication experiments.

The project should be carried out using a mathematical programming language (i.e. Matlab).

Good programming discipline should be followed when writing the Matlab-code. This means that the variable names should be logical, the code must be commented and it should be written in such a way that it is easy to follow and understand. Figures should have appropriate titles and axis labels and use of axis command is recommended (see help: title, xlabel, ylabel, axis).

**Expected results**

The software developed during project activities should be used to optimize future HTS smart gateways implementation strategies.

# Project Work 4

**Title**

Analysis of datasets collected during Q/V-band satellite communication experiments and development of an up-link power control simulator.

**Tutor:**

Tommaso Rossi

**Description**

Project objective is to develop an up-link power control simulator that can be fed by datasets coming from Q/V band satellite communication experiments. The objective is to test and optimize different up-link power control strategies.

The project should be carried out using a mathematical programming language (i.e. Matlab).

Good programming discipline should be followed when writing the Matlab-code. This means that the variable names should be logical, the code must be commented and it should be written in such a way that it is easy to follow and understand. Figures should have appropriate titles and axis labels and use of axis command is recommended (see help: title, xlabel, ylabel, axis).

**Expected results**

The software developed during project activities should be used to find the optimal up-link power control strategies for Q/V-band satellite propagation channel.

# Project Work 5

**Title**

Development of a pre-processing algorithm based on ICA for artifacts removal in microwave UWB radar for head stroke detection.

**Description**

Project objective is to study and develop a statistical algorithm based on ICA (Independent Component Analysis) for artifacts removal. The goal is to optimize this algorithm and to extend its application for the pre-processing phase during head stroke detection using microwave UWB radar.
The algorithm should be carried out using a mathematical programming language (i.e. Matlab). The feasibility and the performance should be compared with the results achieved by other pre-processing algorithms, such as PLSR and PCA-based algorithms. The performance and the comparison should be evaluated using the most used metrics, such as accuracy of stroke localization and artifacts not completely removed by artifact removal phase, and above all an analysis about system computational complexity should be conducted.
Moreover, the sensitivity to noise of this pre-processing algorithm should be assessed.

**Expected results**

The algorithm developed during project activities should be used to improve the pre-processing algorithms performance during head stroke detection

# Project Work 6

**Title**

Wavelet Transform development for noise reduction in microwave UWB radar for head stroke detection.

**Description**

Project objective is to study the applicability of the Wavelet Transform for the pre-processing phase during head stroke detection using microwave UWB radar. The goal is to exploit the Wavelet Transform or as a spectral filtering or as proper artifact removal algorithm. The Wavelet Transform application is crucial in noisy conditions, in which a noise removal phase might be provided.
The algorithm should be carried out using a mathematical programming language (i.e. Matlab). The feasibility and the performance should be compared with the results achieved by a low pass filtering combined with pre-processing algorithms, such as PLSR and PCA-based algorithms. The performance and the comparison should be evaluated using the most used metrics, such as accuracy of stroke localization and artifacts not completely removed by artifact removal phase, and above all an analysis about system computational complexity should be conducted.

**Expected results**

The Wavelet Transform developed during project activities should be used to improve the pre-processing phase performance, especially in noisy conditions, during head stroke detection.