Course offered for the STAT PhD program starting from a.y. 2019/2020

TITLE	**DISCRETE SIGNAL PROCESSING AND DATA INVERSION IN MATLAB**
Lecturer	Egidio Armadillo
Duration and Credits	6 CFU
Course description	The course focuses on the main principle of discrete signal processing and data inversion using MatLab. Main topics: Module 1, 2 credit: introduction to MatLab Introduction to MatLab environment, variables, arrays and matrices, arithmetic, relational and logic operators. Introduction to programming functions in Matlab: conditional and loop control statements, numerical and logical classes, characters and strings, structures, cell arrays, input/output from files Module 2, 2 credits: signal processing Discrete signals and systems. Discrete time linear time-invariant (LTI) systems, convolution sum, impulse response of LTI systems. Systems with finite duration (FIR) and infinite duration (IIR) impulse response. Z transform, poles and zeros of rationale Z transforms. Frequency response of LTI systems, discrete Fourier transform, relationships to the z transform. Digital filters Module 3, 2 credits: data inversion The linear inverse problem, data kernel, undetermined, even-determined and overdetermined problems. Linear inverse gaussian problem. The length method and the least squares solution, weighted measures of length as a type of a priori information, variance and prediction errors. The generalized inverses, data and model resolution matrix, covariance matrix, trade-off curve of resolution and variance. The maximum likelihood methods. Linear inverse problems and non-Gaussian statistics. Non-linear inverse problems, Newton's method
Course organization	Frontal lectures with personal laptop equipped with free MatLab academic Genoa University license
Teaching period	May-June