

MASTER DI I LIVELLO IN
ANALISI DATI PER LA BUSINESS INTELLIGENCE E DATA
SCIENCE

ANNO ACCADEMICO 2019/2020

TITOLO TESI

Validation of a pipeline of multivariate analysis for the combination of
Electroencephalographic data and speech

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Abstract: The language permeates the entire life of human beings; it is essential, and crucially, humans' preferential way to communicate and interact with other people and deeply understand the world in which they are immersed. Without a spoken and written language, it would have been impossible to establish the human culture and the technological advancement that we have achieved as a population. Therefore, it is clear the importance of study and evaluates how the human brain perceives and elaborates languages, starting with low-level components arriving in high-level components and defining language comprehension. This thesis presents a multivariate analysis pipeline for the association of electroencephalographic (EEG) data and speech that I validated during my traineeship in IMT. The proposed pipeline starts from essential features to load and pre-process both the electroencephalographic and the speech data to prepare them for the subsequent analysis. In contrast, the core of the pipeline exploits some functions of the mTRF toolbox and ad-hoc built functions to evaluate the brain entrainment to spoken language and to perform the decoding of data: starting from the EEG data trying to reconstruct the speech envelope extracted from the auditory data. The pipeline has been tested on a single subject to evaluate its performance and the possibility of performing this complex multivariate analysis. However, this work's primary limitation is the necessity of validating this pipeline on a larger sample of data. This is necessary to evaluate the pipeline reliability and produce consistent data across subjects by providing helpful information to understand better how the human brain processes language. However, these preliminary results seem to be valid. The pipeline, revised during the traineeship period, worked correctly, allowing us to take a step forward in comprehending human language and the elaboration that the human brain performs on it.