THE CRM APPLIED MATHEMATICAL PHYSICS (CAMP) SEMINARS

CENTRE DE RECERCA MATEMÀTICA

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Quantified persistence homology: stability and reliability for topological data analysis on fMRI data.

Brain activity can be described as the exploration of a repertoire of different dynamical states. These states are usually defined on the basis of correlations between functional signals, the most notable example being fMRI functional connectivity. However, the exact definition, the properties and even the modalities of transitions among such states are still controversial. Against this background, recent studies shown how topological observables of brain function have emerged as a versatile and powerful candidates to capture robust features of brain processes and describe transformations of the shape of the brain of activation patterns.

However, to date, there has been little focus on the reliability, reproducibility and requirements necessary for the stability of homological features extracted from fMRI data. We take a first step in this direction by investigating to what degree homological features are reproducible in a test-retest resting state fMRI BOLD signal dataset. We find that already simple (one-dimensional) homological features provide discriminative power comparable to the use of the full correlation matrix, while requiring significantly less information, underlying the information compression capacity of topological observables. We then compare the speed at which brain states, both correlation-based and homology-based, change in time. We find that brain states perform a Lévy-like walk in activation space, but intriguingly also find that topological observables provide better discrimination --as compared to correlation matrices alone-- between data and a set of benchmark null models.

Date:	**February 11th, 2019**
Place:	**Room C1/028**
Time:	**12:00**