

NATS: Non-parametric analysis of time series

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1. NATS
2. Background
3. Characterization of SAR image textures in the HC plane

NATS

Main objectives:

- Propose and develop an innovative tool for time series analysis, resulting from recent research proposals related to Information Theory, to facilitate the use of advanced signal processing and analysis techniques.

Specific objectives:

- The need to make techniques accessible to unskilled users, and
- The need to optimize the development of new techniques.

statcomp:

- fis
- global_complexity
- hellinger_distance
- jensen_shannon_divergence
- limit_curves
- MPR_complexity
- ordinal_pattern_distribution
- permutation_entropy
- permutation_entropy_Renyi
- weighted_ordinal_pattern_distribution

pdcc:

- codebook
- hellingerDistance
- pdcDist

The contributions of this work are:

- Implementation of non-parametric time series analysis techniques using causal descriptors from Information Theory;
- The implementation of a friendly graphic interface for the application of such descriptors, maintaining the portability of the software for the different operating systems and hardware architectures.

Background

Time Series are data sets acquired sequentially from an observational process over time, being characterized by the serial dependence existing between its elements.

Applications:

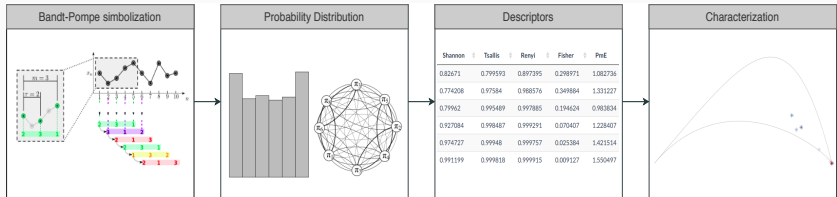
- Stock exchange
- Medicine
- Meteorology

Non-parametric analysis

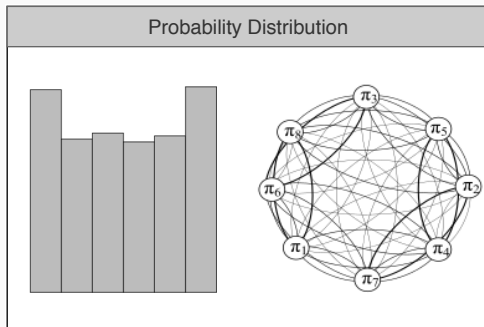
It consists of constructing the probability distribution of some attribute of the time series, and extracting metrics from it.

The approach of using **non-parametric methods** appears in the literature as a way to avoid effects caused by data contamination.

Methodology



Symbolization of Bandt-Pompe



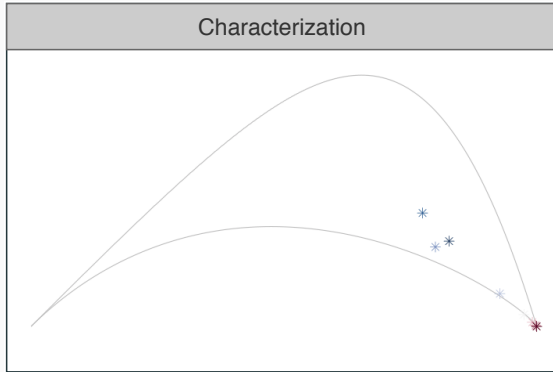
- Bandt-Pompe
- Bandt-Pompe weighted
- Ordinal Patterns Transition Graph
- Weighted Ordinal Patterns Transition Graph

Information Theory Descriptors

Descriptors								
	Series	Shannon	Tsallis	Renyi	Fisher	PmE	SC	
1	series_map_4	0.82671	0.799593	0.897395	0.298971	1.082736	0.168698	
2	series_map_3_6	0.774208	0.97584	0.988576	0.349884	1.331227	0.224306	
3	series_fk_3	0.79962	0.995489	0.997885	0.194624	0.983834	0.157179	
4	series_fk_2_5	0.927084	0.998487	0.999291	0.070407	1.228407	0.065011	
5	series_fk_2	0.974727	0.99948	0.999757	0.025384	1.421514	0.023752	
6	series_fk_1_5	0.991199	0.999818	0.999915	0.009127	1.550497	0.008465	
7	series_fk_1	0.997679	0.999951	0.999977	0.002536	1.652667	0.002263	
8	series_fk_0_5	0.99946	0.999989	0.999995	0.00069	1.710717	0.000529	
9	series_fk_0	0.999951	0.999999	1	4.9e-05	1.774113	4.8e-05	

- Permutation Entropy
- Stochastic Distances
- Statistical complexity

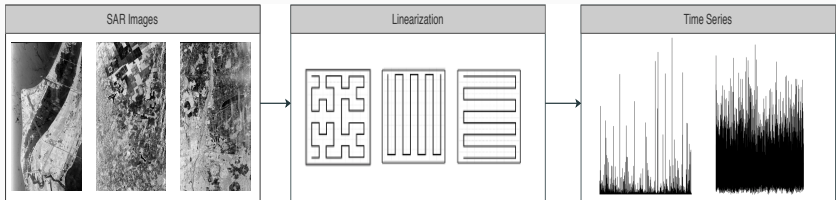
Characterization



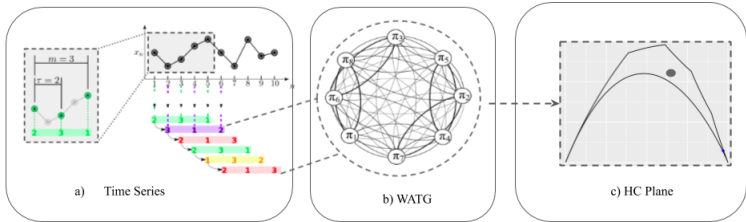
- HC Plane
- Fisher Plane

Characterization of SAR image textures in the HC plane

Linearization Process



Methodology



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