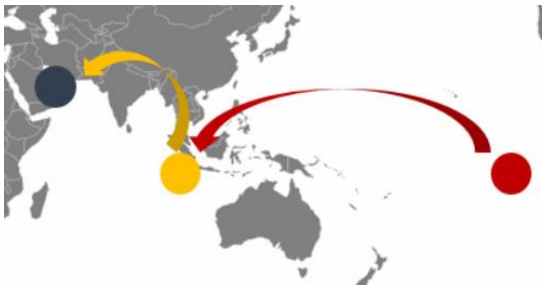
DETECTING CAUSAL PATTERNS IN CLIMATE DATA

Background

Earth observation satellite data provide a wealth of information about the dynamics of our planet in recent decades. Composite global records of important environmental and climatic variables now span up to 30 years, enabling the study of climate–vegetation interactions over multi-decadal scales. These records have the form of multivariate time series with different spatial and temporal resolutions.

Climatic conditions are known to be key drivers of ecosystem dynamics, which are sensitive to temperature, availability of water and the solar irradiance. In the other direction, vegetation has a major influence on climate systems on a global scale. Statistical methods and machine learning techniques can be applied on these data in order to help in discovering correlations and forming models that may predict future states.

There are no prerequisite courses but an interest in machine learning and data driven methods is appreciated. The course of predictive modelling is strongly recommended during the first semester.



Scope of the thesis

The aim of this thesis is the discovery of hidden causal patterns between the different climate drivers and vegetation. Specifically, the effects of these drivers on vegetation will be investigated for each area of the world. Machine learning techniques, such as feature construction and feature selection, can help in modelling patterns that may exist in the data. Depending on the interest of the student, causality frameworks that make use of these techniques, see [1, 2], will be explored and applied on spatio-temporal datasets for the study of climate-vegetation dynamics.

References:

[1] Papagiannopoulou C., et al. Vegetation anomalies caused by antecedent precipitation in most of the world. Environmental research letters. 2017;12(7).

[2] Runge, J., et al. (2015). Identifying causal gateways and mediators in complex spatio-temporal systems. Nature communications, 6, 8502.

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BACKGROUND

All

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