

Visual Analytics of Spatial Time Series Data

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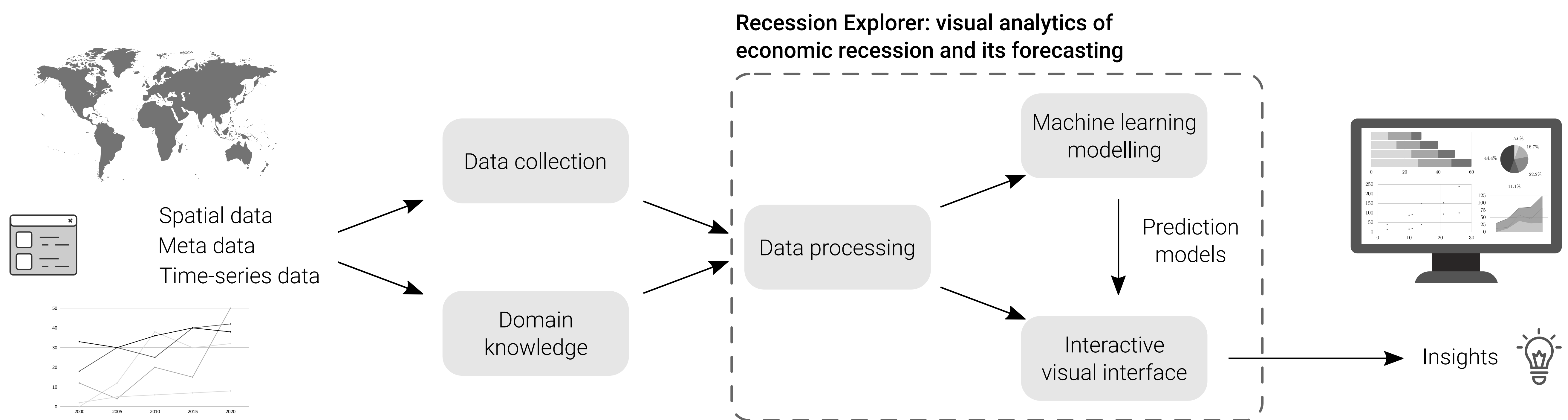
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Introduction

Analysis of spatial time series data is inherently challenging due to their complexity and size. As such, it is suitable for implementation of visual analytics techniques.

One clear example of such complex processes is the economic recession. Often described in terms of recession factors such as GDP, the Gini index, or inflation, whose change is a clear indicator of the state of the economy. Without clearly defined impact of the economic factors, purely automated techniques are not appropriate for recession analysis and there is scope for advances in analytical approaches.

Approach

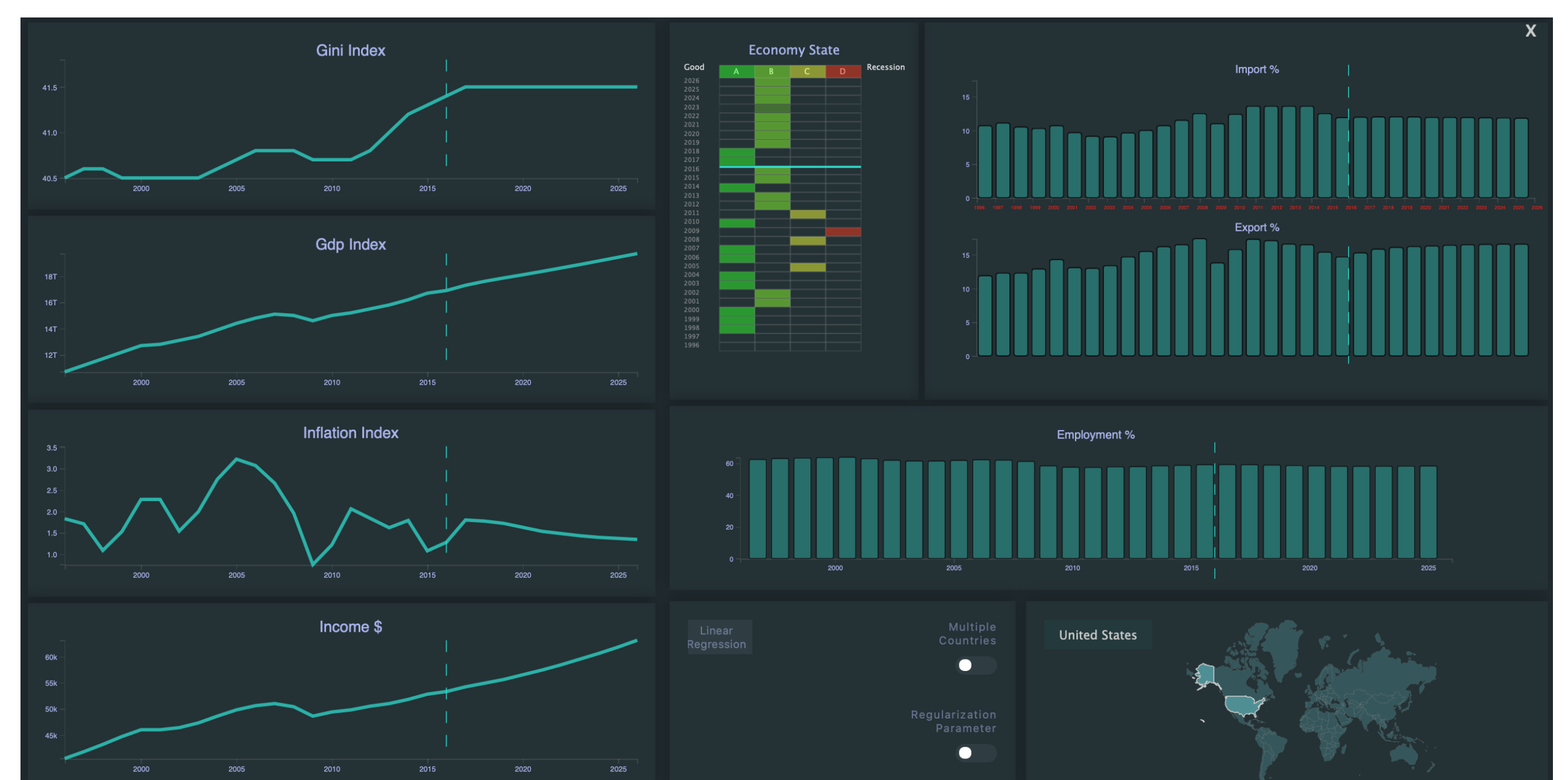


Data collection and processing: recession factors such as GDP, inflation and employment rates are collected from Gapminder (86 countries, from 1992 to 2016) and cleaned and transformed (normalized) to be suitable for mathematical and visual analysis.

Machine learning modelling: linear regression models with elastic net regularization are developed on historical data of recession factors. Based on generated forecasts, K-Means classification of the recession is performed. Simplistic linear models were chosen as they are interpretable and impact of each individual economic factor is clearly shown, thus suitable for visualization.

Interactive visual interface: the user interface dashboard consists of an interactive world map combined with line and bar charts of economic factors and their forecasts in relation to each country. Along the country selection, users have the option to visualize details of the charts and highlight specific time periods for all factors shown. In addition, up to three countries can be selected for comparison.

Recession Explorer: visual analytics of economic recession and its forecasting: combining computational processing with visual representation of the data, the application supports the workflow of spatial time series analysis and guides the user through the process with interactive options and cross-referencing of data.



User stories are designed according to the envisioned application usage and a set of user tasks is formulated for the evaluation process. Visualisation of historical and future trends of economic factors, comparisons between multiple countries and identification of the incoming recession periods, are among the defined user tasks. Evaluation through the use case scenarios shows the support and benefits of the application usage in the process of economic recession analysis.