Efficient machine learning methods for real estate market analysis and city development

Stanimir Kabaivanov, Veneta Markovska

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Plovdiv University   UFT - Plovdiv
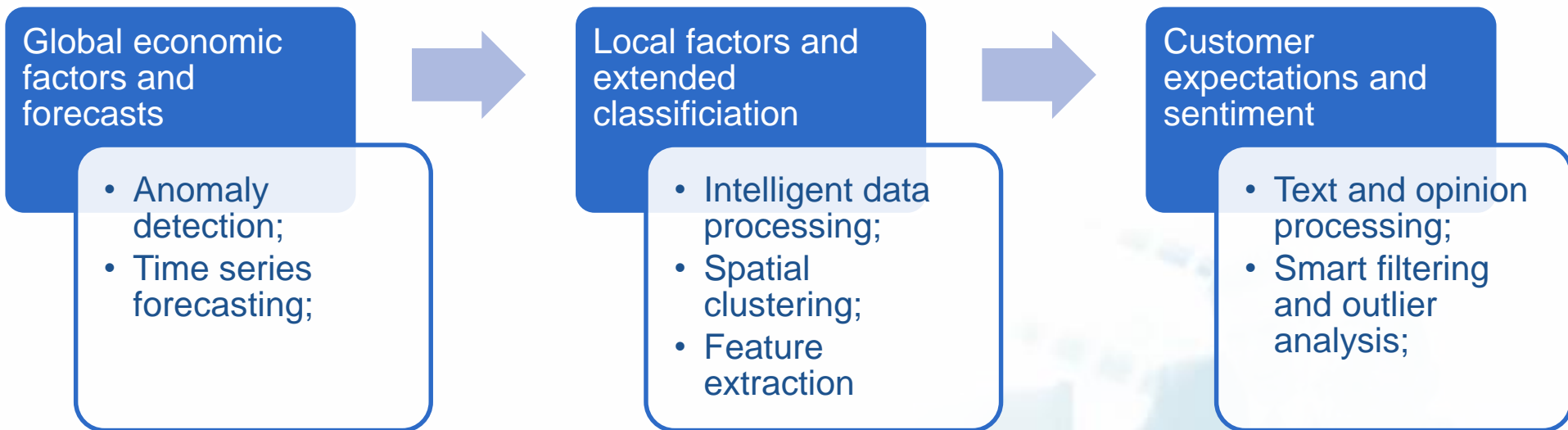
- Why is machine learning important for real estate market and city development?
  - Deals depend on global economic factors as well as individual characteristics of each property.

  - Real estate is a major component of individual wealth and impacts economic behavior.

  - Real estate market can influence migration and regional development.

- **Major areas of implementation**

Global economic factors and forecasts

- Anomaly detection;
- Time series forecasting;

Local factors and extended classificiation

- Intelligent data processing;
- Spatial clustering;
- Feature extraction

Customer expectations and sentiment

- Text and opinion processing;
- Smart filtering and outlier analysis;

- Factors affecting property pricing
  - Location, location, location…
  - Comparable properties
  - Updates and Upgrades
  - Appraisal value
- Macro factors affecting property pricing
  - Growth and outlook
  - Interest rates
  - Building activity
  - etc.

- ## Anomaly detection as part of the big picture

| Use case	Use	Solutions available
Anomaly detection	GEFF	Data reconstruction; Generative adversarial network (GAN).
Time series forecasting	GEFF	Long short-term memory neural networks (LSTM); Multilayer perceptrons (MLP); Convolutional (CNN) and Recurrent (RNN) neural networks.
Scenario analysis	GEFF	GAN for model-free scenario generation.
Solving high dimensional problems		Convolutional neural networks; Multilayer neural networks with special handling (for example random projection).

Data used

- Considering the characteristics of real-estate market

Parameter	Value
Frequency	Monthly non-seasonally adjusted observations, US data only
Start date	January 1991
End date	June 2020
Number of entries	354
HPI features	Mean 178.2224; Std. dev. 52.62714; Min. 100; Max. 295.8

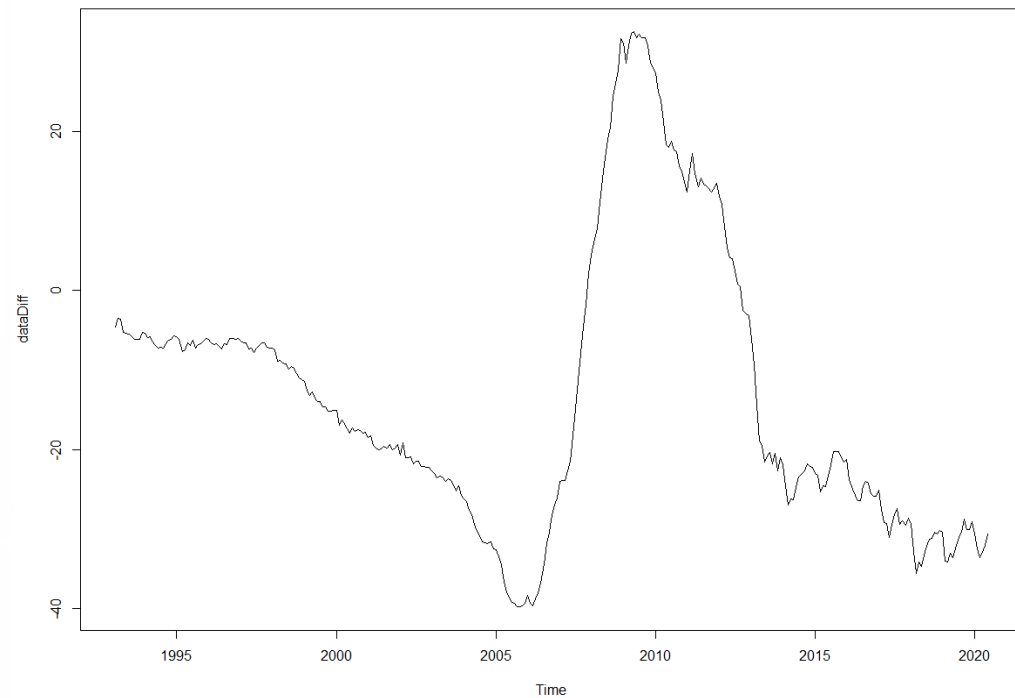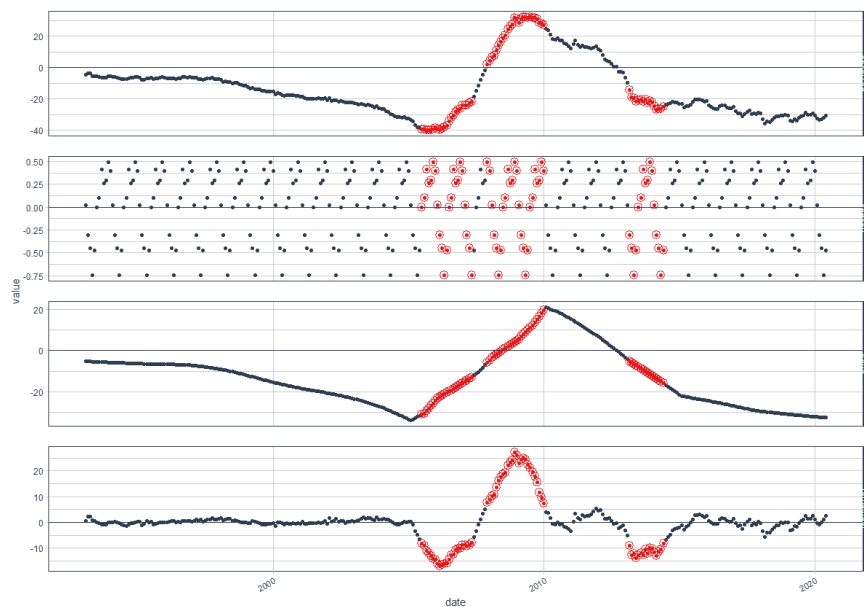## Generalized ESD results over the whole period January 1991 – June 2020
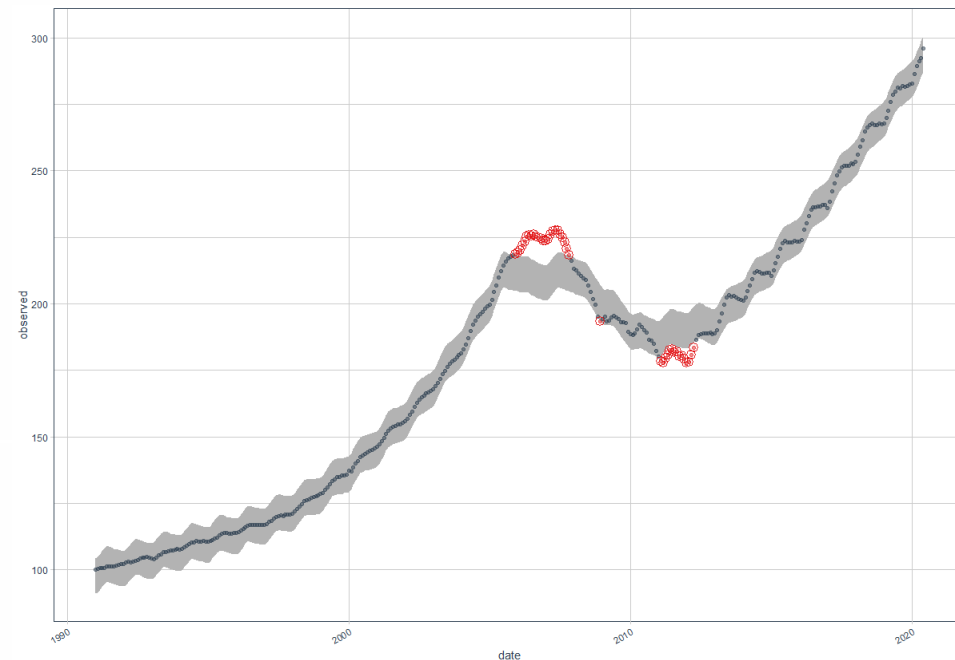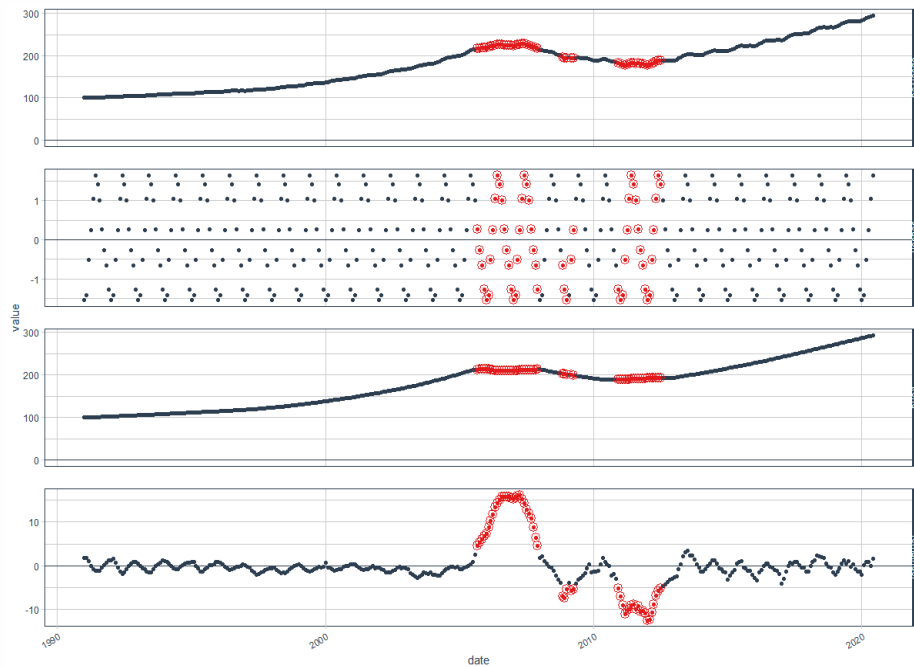
Anomaly detection based on error changes (right panel) of the MLP network, over the whole period January 1991 – June 2020.

- **Main conclusions**

1) Crisis events and significant changes in the market are successfully detected by both methods. In general, this makes it possible to better understand price changes and prepare for economic slowdowns and market downturns.

2) Seasonality and long-term trends are be accounted for in both cases, thus providing better insight on the forces that drive market changes.

3) Anomaly detection based on neural network output seems to detect the events a bit earlier, compared to the initial approach. This may have significant economic impact, since being able to tell in advance, that there is a special event or situation, helps react on time and gain competitive advantage.

THANK YOU FOR YOUR ATTENTION!