



Forecasting the UK Housing Markets with Artificial-Intelligence-Based Big Data Analytics

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Presentation Guide

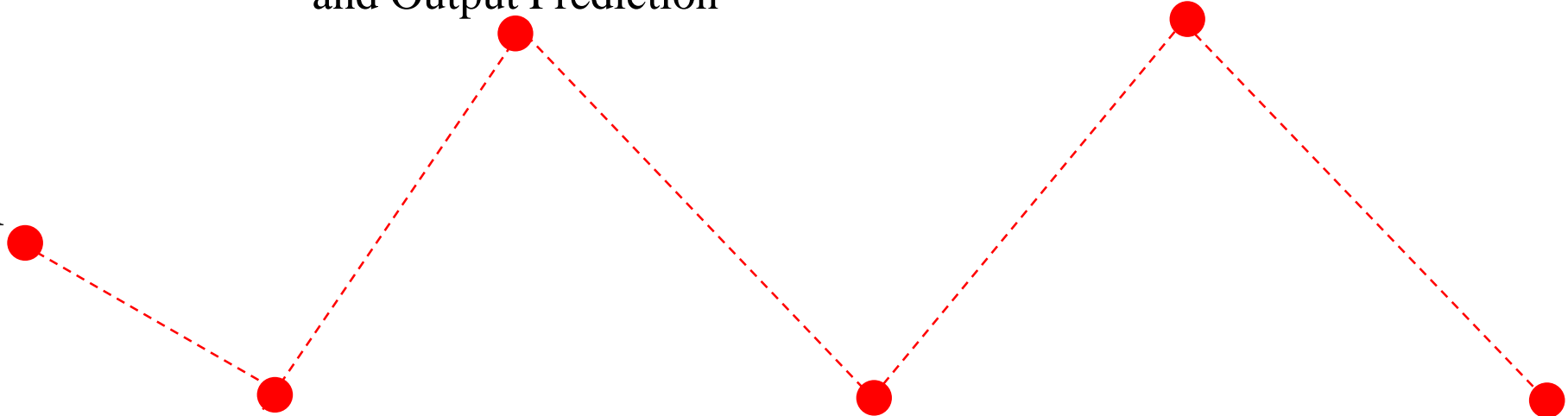
1 Big Data Forecasting:
Opportunities and Challenges

2 Current Practices in Housing Price
and Output Prediction

3 AI Based TRUST
Framework

4 Big Data Economic Forecast
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5 Conclusion and Proposal



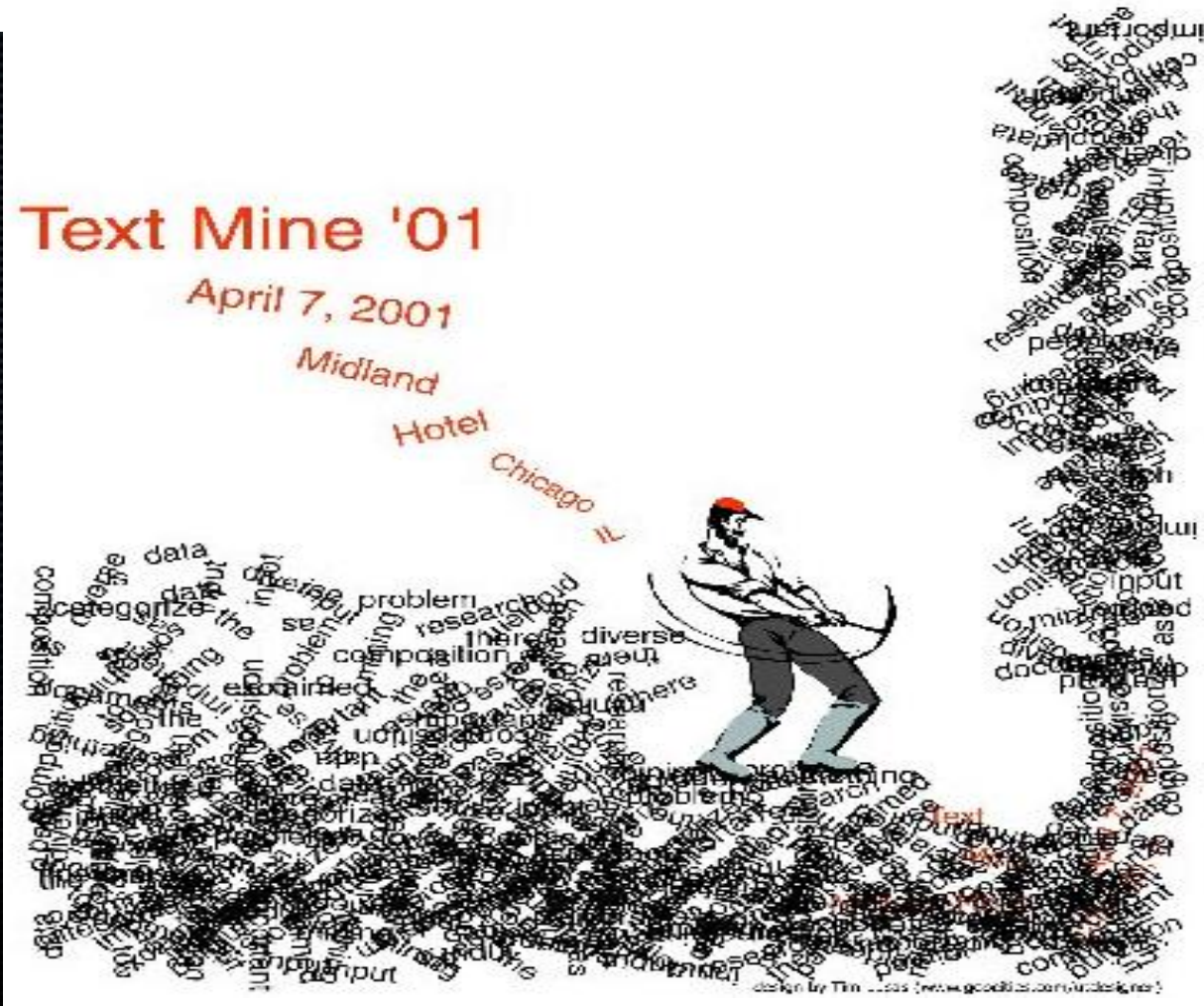
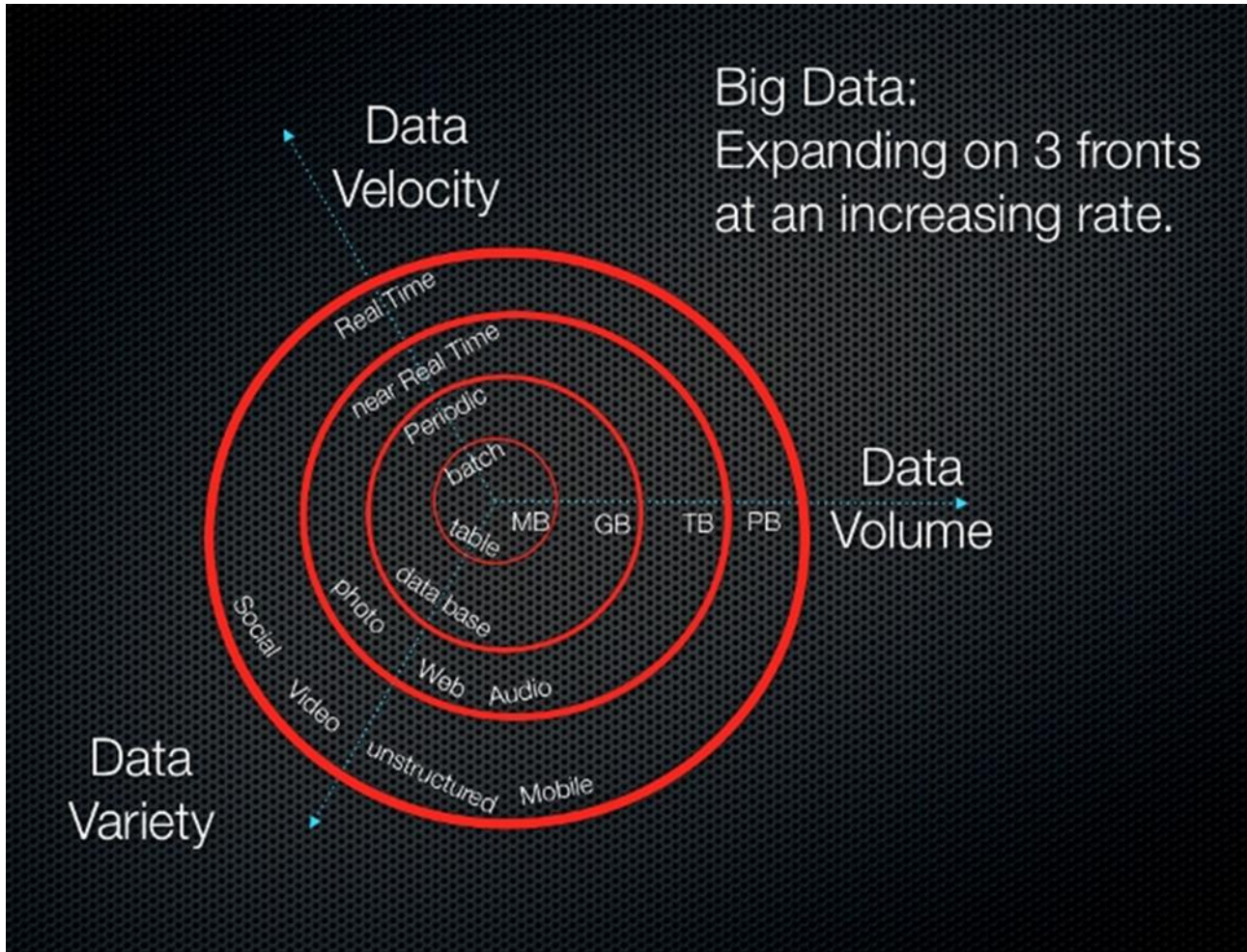


Difficulties in Prediction

1. Key factor Identification
2. Unpredictable Human Behaviour
3. Risk and Uncertainty

We Need Big Data Analytics. But What is Big Data?

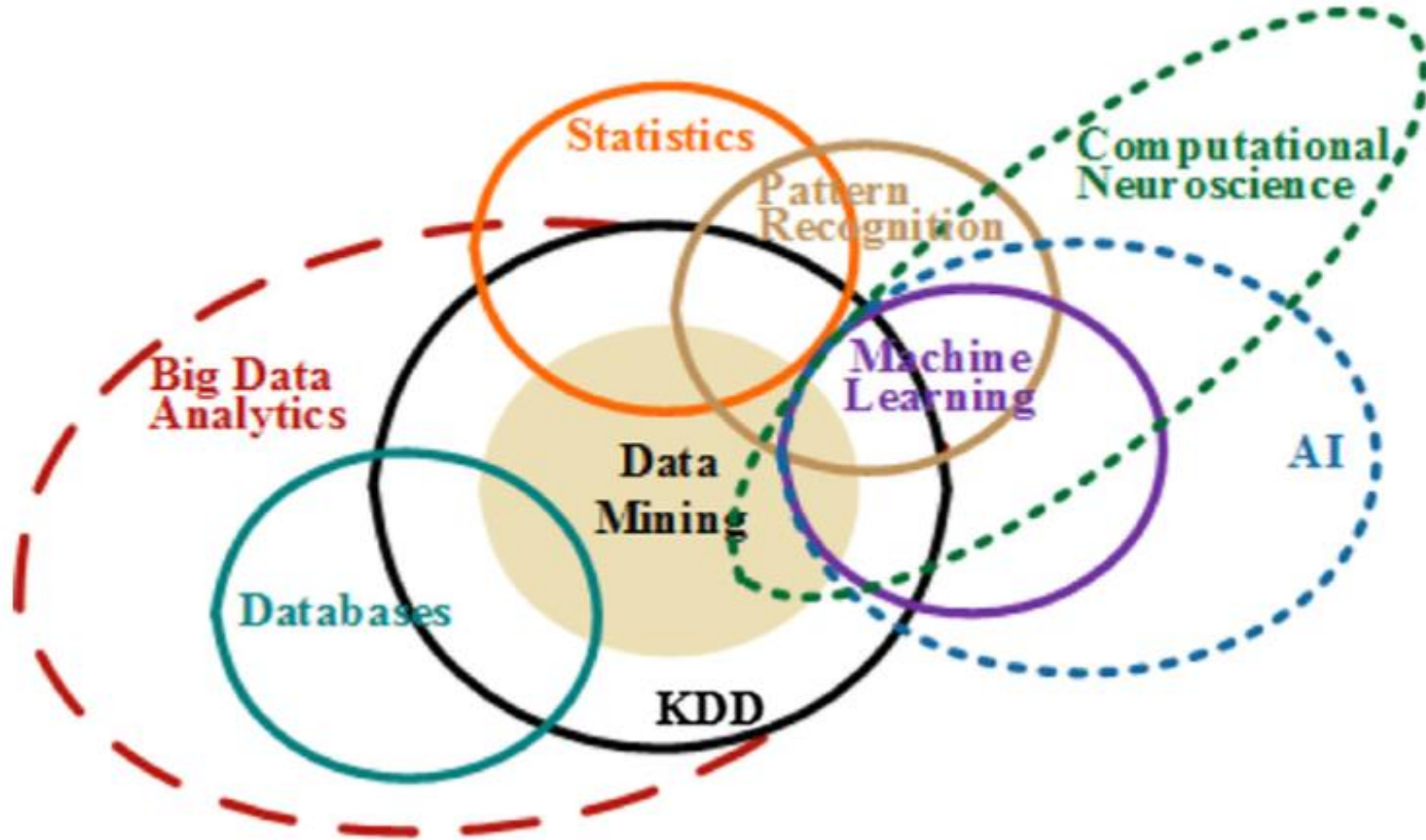
Big Data:
Expanding on 3 fronts
at an increasing rate.



Big Data Forecasting: Room for Improvement

- **Theoretical** framework based on behavioral, economic, political research
- Combination of **various** Big Data sources
- Coherent adoption of **traditional** data sources (Passive + Active)
- Combine recent improvement in **statistical** modelling with machine learning and other AI-related tools

Figure 1: Multidisciplinary nature of Big Data analytics



Application of Big Data Analytics in Construction and Housing Markets

- **Machine Learning** (Bilal et al., 2016): regression, classification, clustering, natural language processing, and information retrieval.
- **Regression and classification** techniques are supervised machine learning techniques including **logistic regression, naive Bayes, decision trees, support vector machine (SVM), artificial neural networks (ANN) and genetic algorithms (GA)**.

Unsupervised machine learning methods

- Unsupervised machine learning methods including **clustering, natural language processing, and information retrieval.**
- Al-Qady et al. (2009) and Zhang and El-Gohary (2012, 2013) use **NLP** to automatically extract **concept relationships** from construction contractual and regulatory documents.

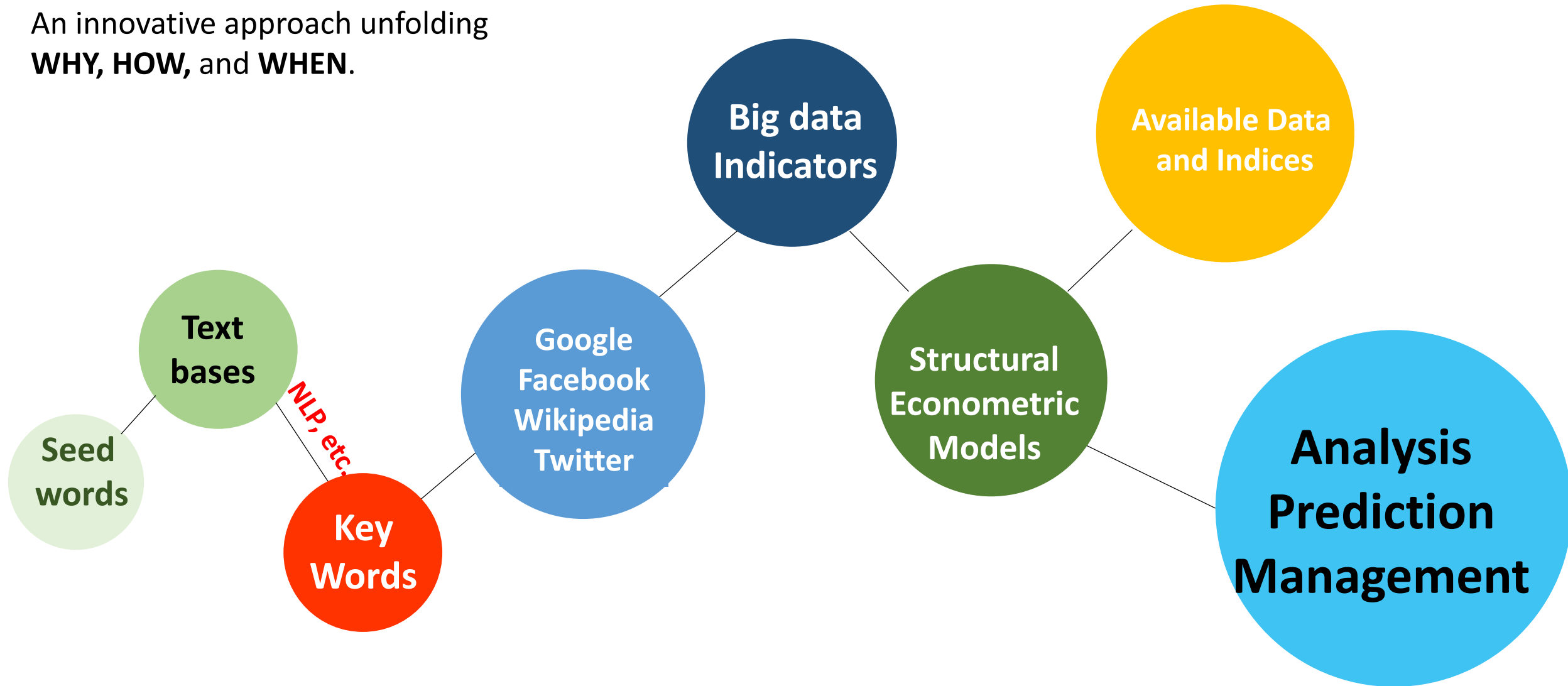
Predictions with Google Search Indices

- Google Trends indexes are useful in forecasting trends in **stock prices** (Da, et al., 2011), **stock price volatility and trading volume** (Vlastakis and Markellos, 2012; Aouadi et al., 2013; Takeda and Wakao, 2014), **exchange rate volatility** (Goddard et al., 2015) and **financial index returns** (Vozlyublennaia, 2014).
- Macdonald and Mao (2015, 2016) Scottish referendum & UK **elections**
- Wu and Brynjolfsson (2015) , Das et al. (2015) and **Wei and Cao (2017)** forecasting power of the Google search index has increased significantly since 2009 to 2014 and the Google search index has become the best predictor for the house price in China.

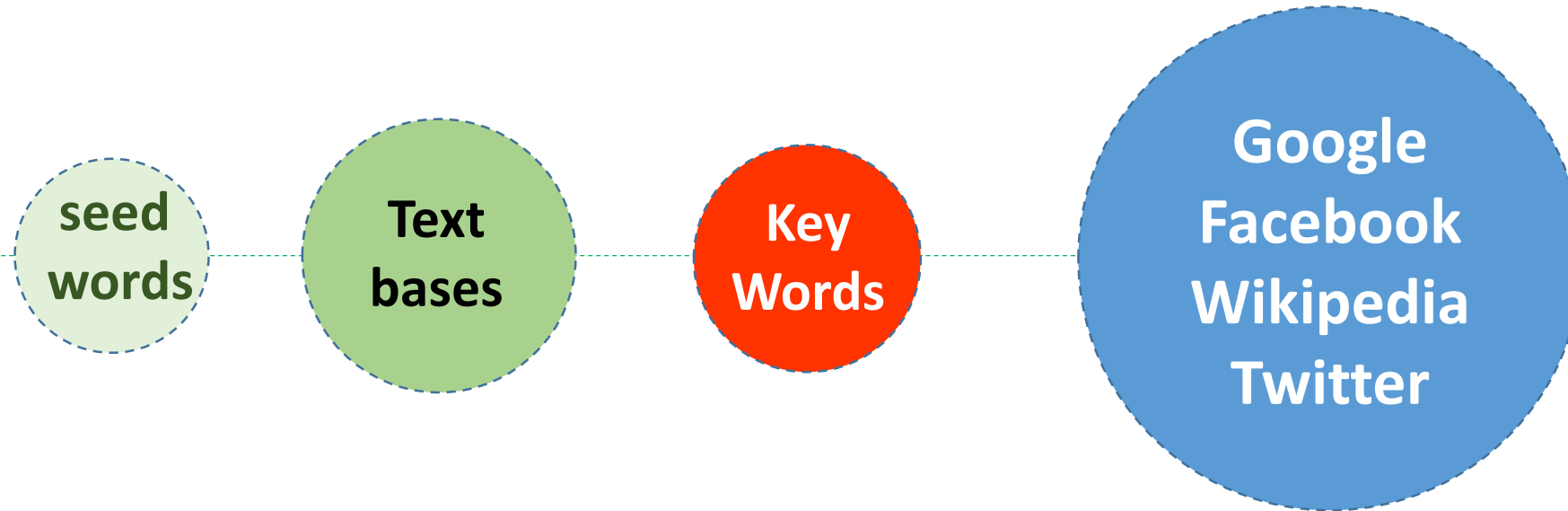
TRUST Methodology

The **T**opic Retrieved, **U**ncovered and **S**tructurally Tested methodology

An innovative approach unfolding
WHY, HOW, and WHEN.



Retrive and Uncover Key Topics through Data Mining



- Use **'seed words'** to find from internal or external databases all related texts and graphs, e.g., thousands of reports and photos, related to the construction sector.

- Adopt the Latent Dirichlet Allocation (LDA) Methodology to find the key words or phrases on the construction project.
- **Advantage:** we can catch the key themes that government and society pay attention to.

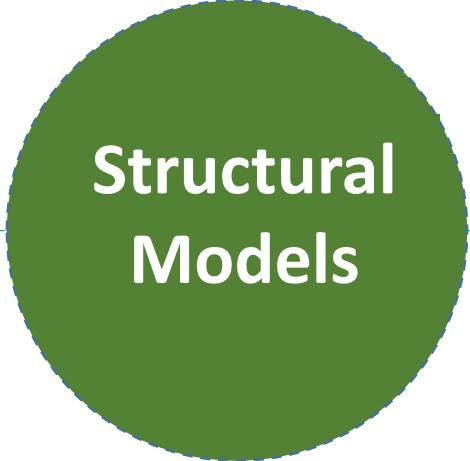
- Why not analyse social media big data directly?
- The available database are more structured than the social media big data, and can provide more related key words

Use Text/Graph Mined keywords to build Big Data variables.



- I can build big data indicators measuring people's information interest through the Google search volume, Twitter Analytics and Wikipedia page views, etc.

Structural Models and Projections with Big Data and Standard Data



Structural Models

- **Variables:** Big Data indicators and traditional variables
- Adoption of advanced structural modelling techniques, such as Panel VAR and cointegration models.
- Robust modelling and projection guaranteed with state-of-art structural models and real-time Big Data indicators.



**Analysis
Prediction
Management**

We can not only model and forecast the trends and scenarios, but also able to manage the trends by changing government and society's information interests on specific topics!

Text Documents related to UK Housing Sector

News

My Favourite Search Forms ▾

Power Search

News

Company Profiles

Market Insight

Geographies

Useful Links

Help me search news

View tutorials

News

In the Headline ▾

Search

Or ▾

In the Headline ▾

✕

And ▾

In the Headline ▾

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- Group duplicates (High similarity edit)
- Exclude Newswires
- Exclude Non-business news (obituaries, sports, reports, etc.)
- Exclude Websites
- Exclude documents with fewer than 500 words

Topics Based on Natural Language Processing

Period	Key Topics and Phrases/Real Estate
Jan 2004 - Mar 2008	Price, Rise, Mortgage, Interest, Rate, Economy, Growth, Property, Housing, Investment
Apr 2008 – Sep 2009	Price, Rise, Fall, Mortgage, Interest, Rate, Economy, Growth, Property, Housing, Investment, House, Building
Oct 2009 – Jun 2016	Price, Rise, Mortgage, Interest, Rate, Economy, Growth, Property, Housing, Investment, House, Building
Jul 2016 – Nov 2017	Brexit, Price, Rise, Mortgage, Interest, Rate, Economy, Growth, Property, Housing, Investment, House, Building
Summary of Topics	house price, house price rise, house price fall, mortgage rate, interest rate, UK property Investment, housing investment, property investment, house building, inflation, recession, Brexit

Big Data Factors Influencing Housing Output and House Price

(Only statistically significant coefficients are shown in the table.)

	Housing Output	House Price
house price		
house price rise	0.02	0.40
house price fall		
mortgage rate	-0.04	
interest rate		
UK property investment		
housing investment		
property investment		
house building		0.77
inflation	-0.08	
recession	-0.02	
Brexit		

Big Data Forecast Errors of Housing Output and House Price

Housing Output Forecasts			
	Forecast	Actual	Forecast Error
July 2017	-0.10	0.43	0.53
Aug 2017	-0.02	0.80	0.82
Sep 2017	0.02	0.97	0.95
Mean (Error) = 0.77; SD (Error) = 0.18			
House Price Forecasts			
July 2017	0.64	0.90	0.26
Aug 2017	0.31	0.07	-0.24
Sep 2017	0.15	0.43	0.28
Mean (Error) = 0.10; SD (Error) = 0.24			

Macroeconomic Factors Influencing Housing Output and House Price

(Only statistically significant coefficients are shown in the table.)

	Housing Output	House Price
UK GDP		0.61
UK Overall Unemployment		
Inflation Rate		
Three Month Bill Rate	-0.02	
Ten Year Bond Yield		
Exchange Rate		
Macroeconomic Sentiment		

Macroeconomic Forecast Errors of Housing Output and House Price

(Only statistically significant coefficients are shown in the table.)

Housing Output Forecasts			
Horizon	Forecast	Actual	Forecast Error
July 2017	-0.12	0.43	0.53
Aug 2017	-0.10	0.80	0.90
Sep 2017	-0.06	0.97	1.04
Mean (Error) = 0.83; SD (Error) = 0.17			
House Price Forecasts			
July 2017	0.95	0.90	-0.05
Aug 2017	0.70	0.07	-0.63
Sep 2017	0.57	0.43	-0.14
Mean (Error) = -0.27; SD (Error) = 0.25			

Market Conditions Factors Influencing Housing Output and House Price

(Only statistically significant coefficients are shown in the table.)

	Housing Output	House Price
UK Construction Unemployment		
GB Construction New Order		
GB Housing New Order	0.04	
UK Construction Weekly Earnings		0.04
UK Construction Confidence		

Forecast Errors of Housing Output and House Price Based on Market Conditions

(Only statistically significant coefficients are shown in the table.)

Housing Output Forecasts			
	Forecast	Actual	Forecast Error
July 2017	-0.03	0.43	0.46
Aug 2017	0.02	0.80	0.77
Sep 2017	0.03	0.97	0.94
Mean (Error) = 0.72; SD (Error) = 0.20			
House Price Forecasts			
	Forecast	Actual	Forecast Error
July 2017	0.91	0.90	-0.01
Aug 2017	0.46	0.07	-0.39
Sep 2017	0.23	0.43	0.20
Mean (Error) = -0.07; SD (Error) = 0.24			

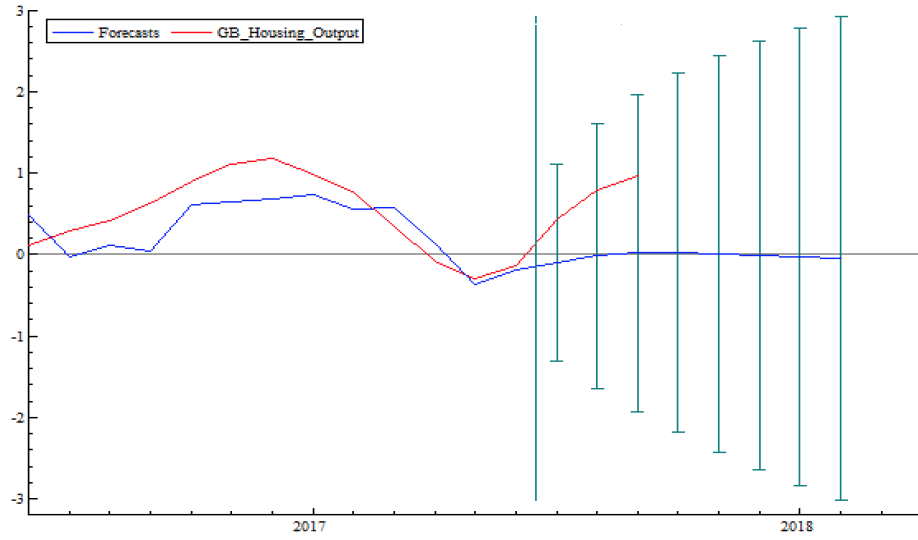
All Factors Influencing Housing Output and House Price

(Only statistically significant coefficients are shown in the table.)

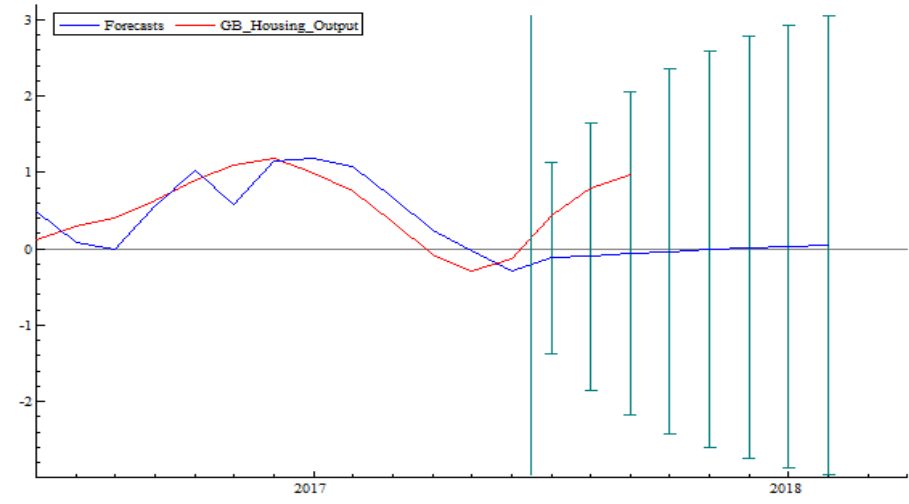
	Housing Output	House Price
UK GDP		0.76
GB Housing New Order	0.03	
UK Construction Weekly Earnings		0.03
house price rise (Big Data)	0.02	0.01
Inflation (Big Data)	-0.05	
Recession (Big Data)	-0.01	-0.02
Brexit (Big Data)		

Housing Output Forecasts			
	Forecast	Actual	Forecast Error
July 2017	0.52	0.43	-0.09
Aug 2017	0.72	0.80	0.08
Sep 2017	0.47	0.97	0.50
Mean (Error) = 0.16; SD (Error) = 0.25			
House Price Forecasts			
July 2017	0.73	0.90	0.17
Aug 2017	0.34	0.07	-0.27
Sep 2017	0.57	0.43	-0.14
Mean (Error) = 0.04; SD (Error) = 0.22			

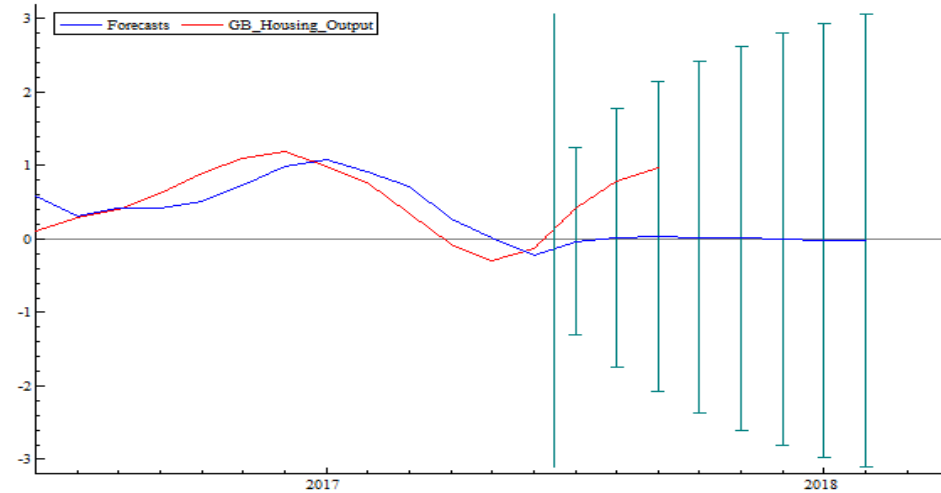
Forecasting Housing Output only with Big Data



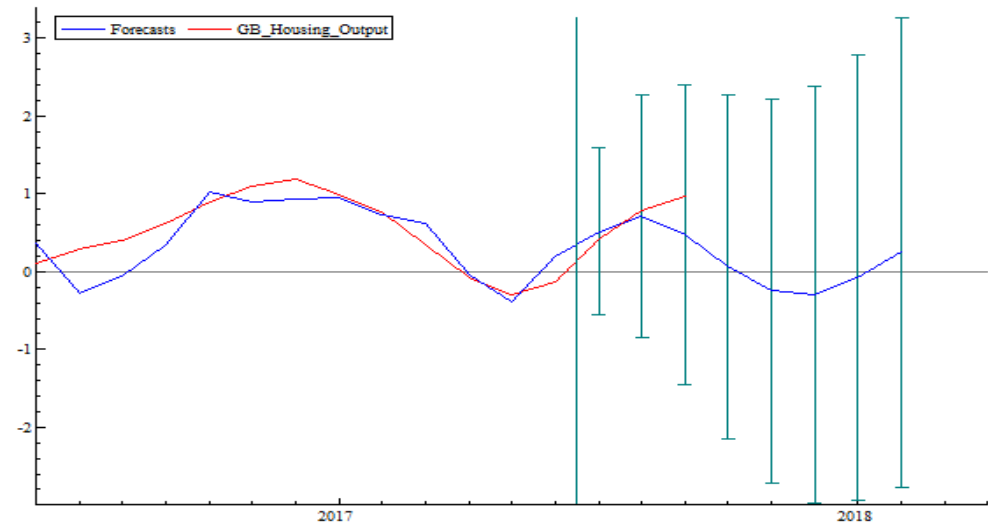
Forecasting Housing Output with Macroeconomic Variables



Forecasting Housing Output with Construction and Housing Market Conditions



Forecasting Housing Output with All Available Variables



Conclusions and Proposals

- AI-based **big data** analytics can help to **explain** the short-term dynamics
- **short-term, robust predictions** over three quarters, by taking into consideration **all** available information (**Macro, Market and Big Data**)
- Big Data is **not to replace** the traditional models, but **improves** the accuracy of forecasting with more information and techniques
- More robust **long-term** analysis and forecasts?