

TEXT MINING BASED IDENTIFICATION OF EMERGING TECHNOLOGIES AND BUSINESS MODELS FOR SMART ENERGY SYSTEMS

Jiao Jiao
(Fraunhofer Institute for Systems and Innovation Research ISI)
Yuwei Wang
(Daimler AG)

Why Identify Emerging Technologies and Business Models

- For the Industry
 - Gain first-mover advantages in the market competition
 - Enhance their competitiveness
- For the Academic
 - Monitor the whole market
 - Wisely boost and invest the industry

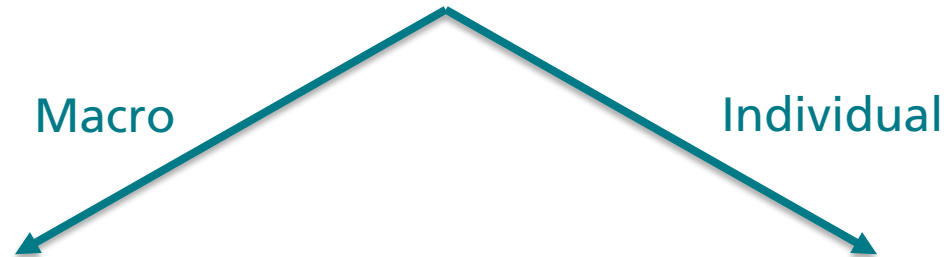
Why Text Mining

- Why text mining + visual analysis
 - Efficiently cluster texts into groups and highlight the key ideas
 - Easy to understand a fuzzy concept
 - Efficiently and effectively represent the concept spreading over a long timeframe

1 Million Surveys

over 30 Years

User-Generated Data



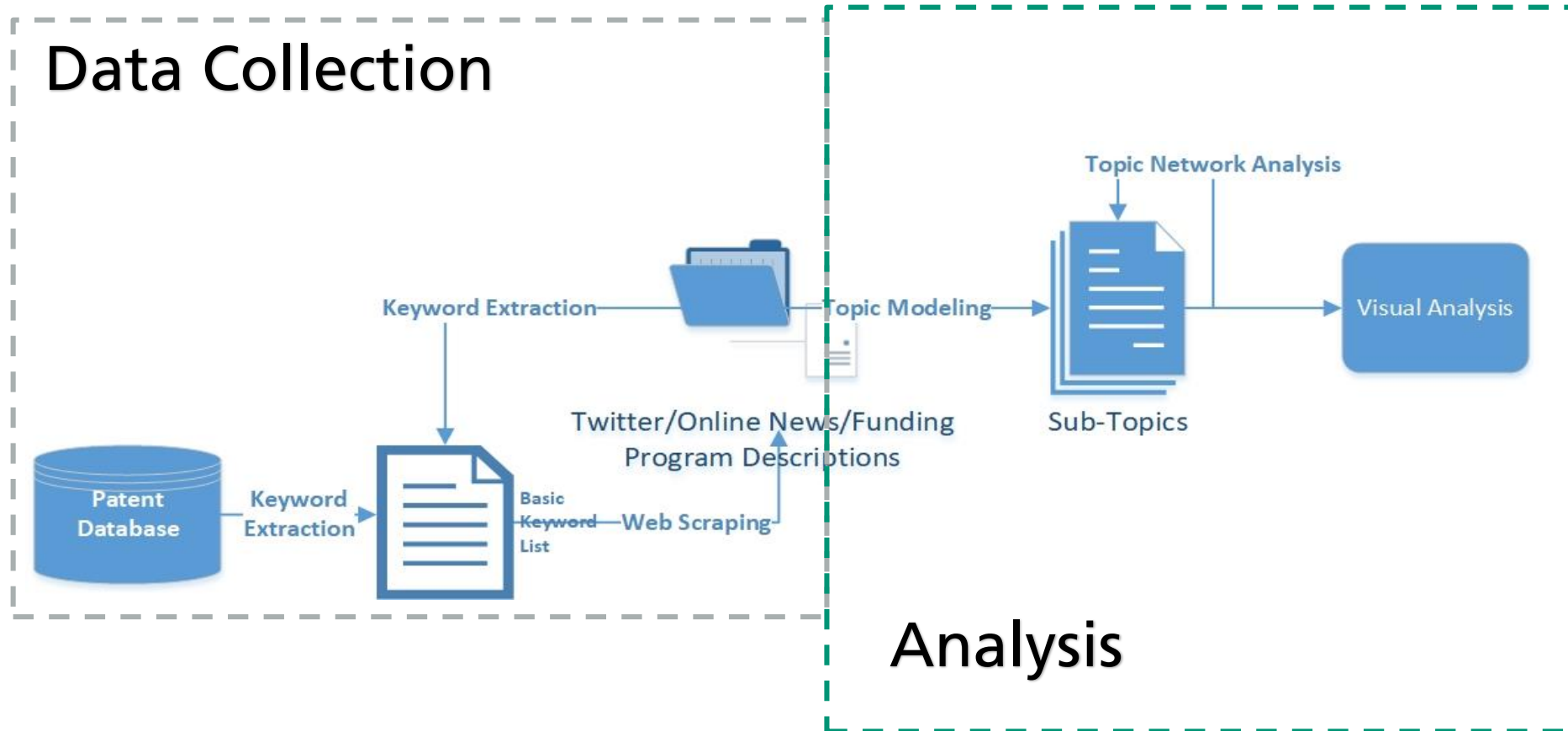
Online News



Social Media

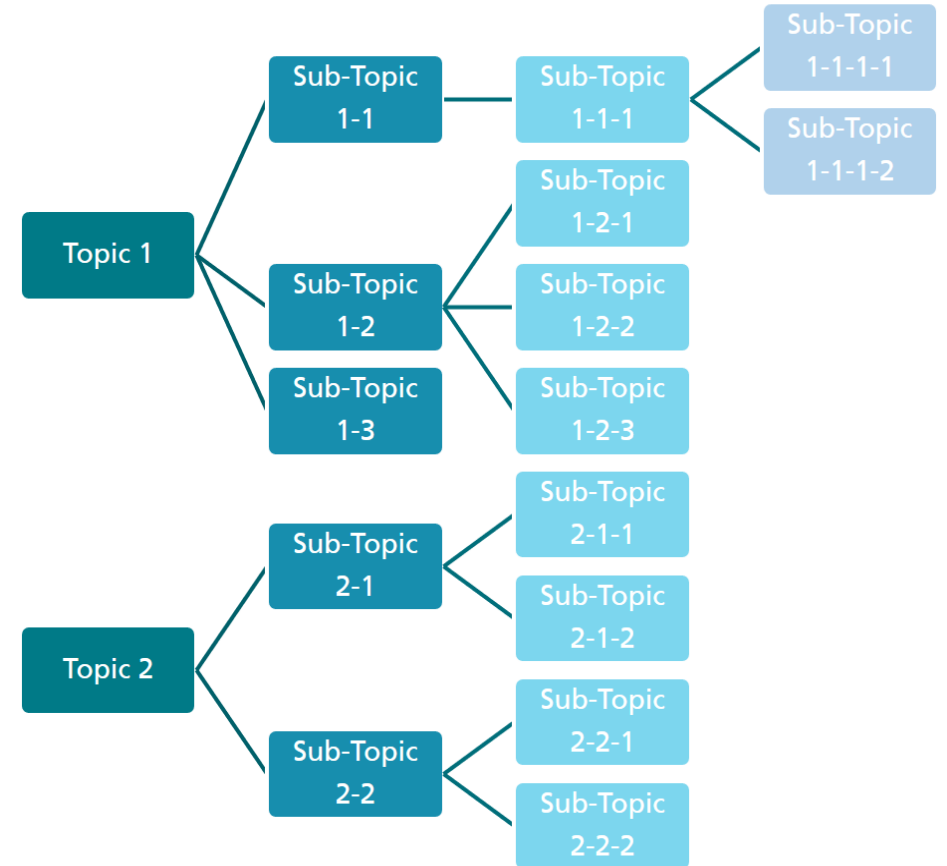
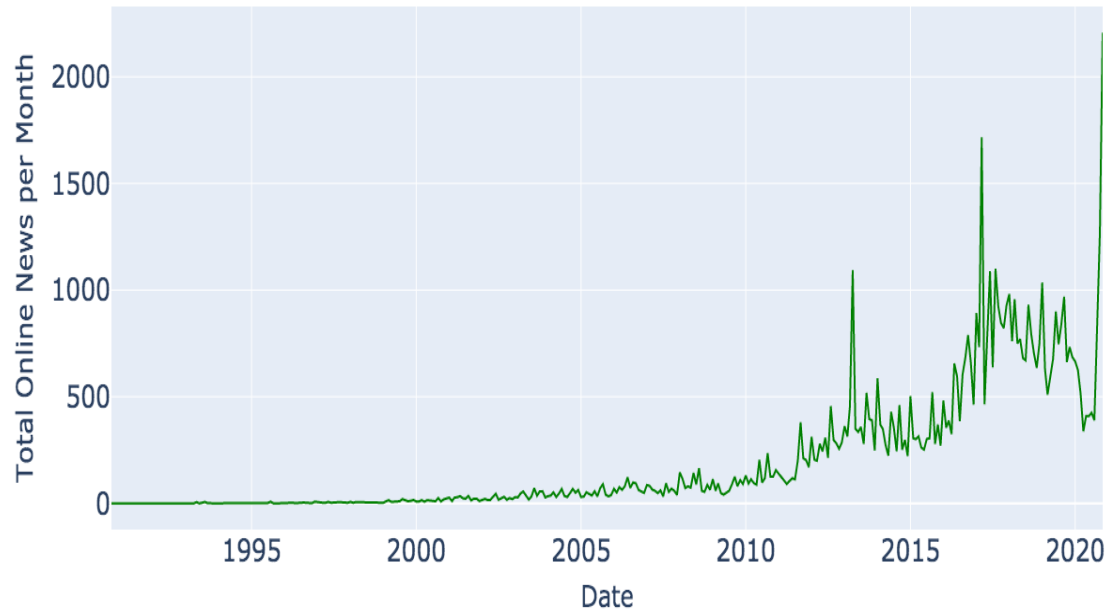


Framework

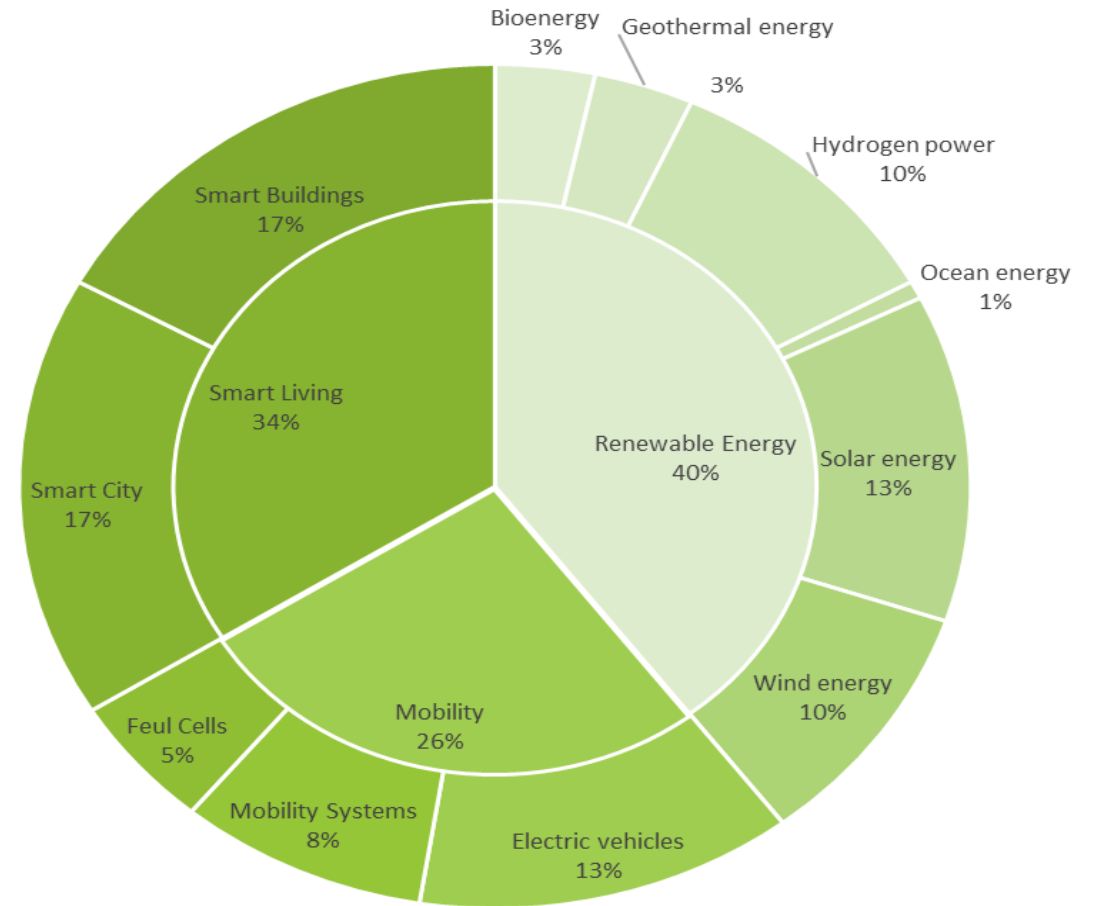
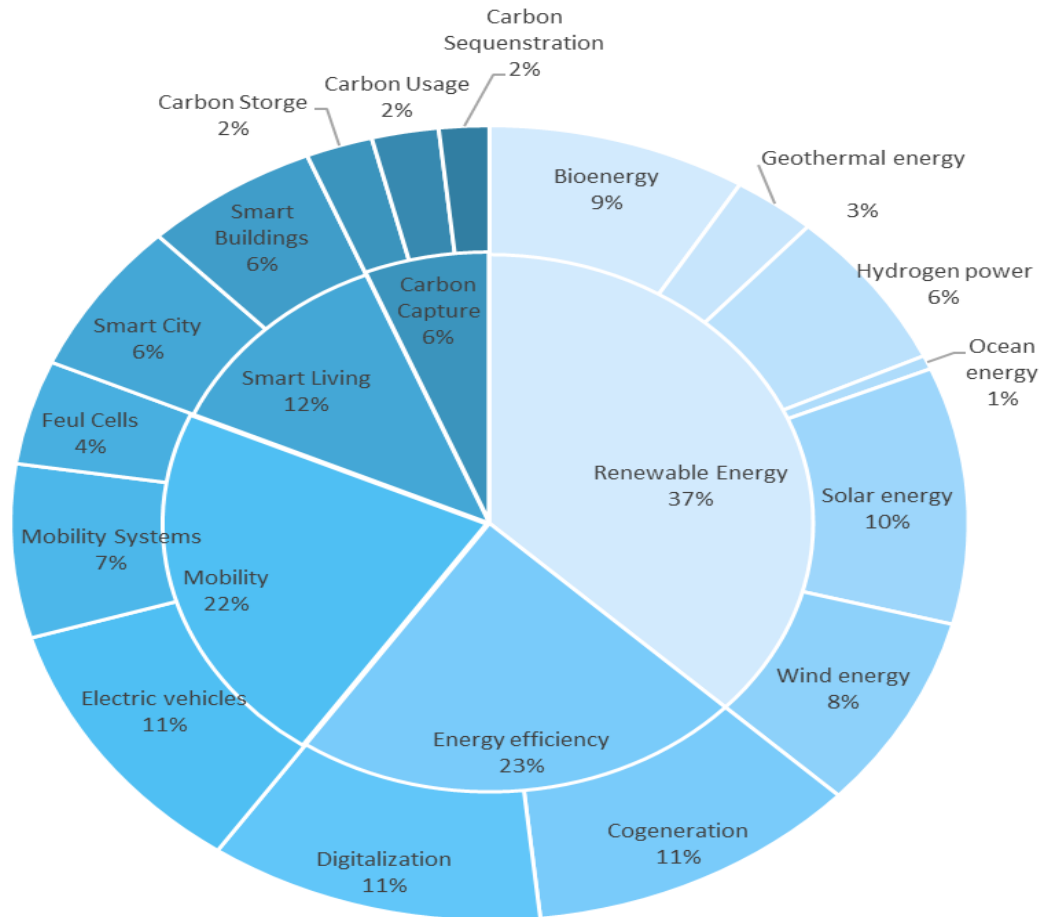


Topic Modeling + Visual Analysis

- Hierarchical Biterm Topic Modeling based on Keywords
- Time Series Visualization



Topic Analysis



Keywords from Smart Living Topic



Online news/Funding Programs:

Policy-oriented

Written style



Twitter:

Daily life-oriented

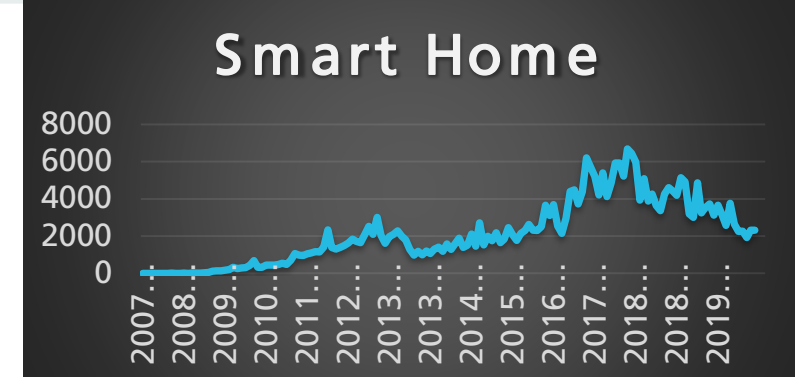
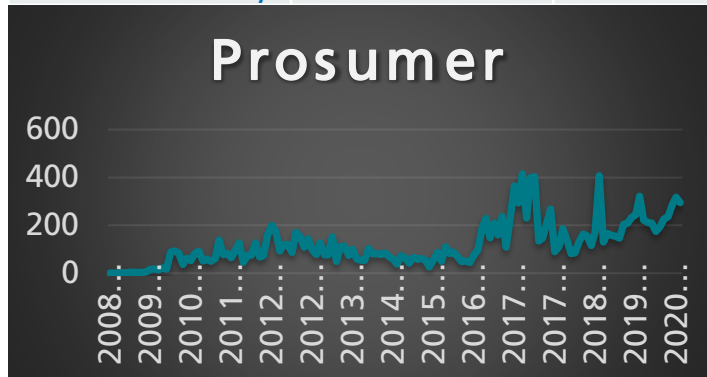
Spoken style

Technology and Business Model Identification from Online news/Funding Programs

Renewable energy						Energy efficiency		Mobility			Smart living		Carbon Capture
Solar energy	Bioenergy	Wind energy	Hydrogen power	Geothermal energy	Ocean energy	Cogeneration	Digitalization	Electric Vehicles	Mobility systems	Fuel Cells	Smart city	Smart buildings	Carbon Storage
photovoltaics	biofuels	wind turbine	hydropower	geothermal wells	tidal factory	CHP	energy monitoring	Vehicle2Grid	ADAS	fuel cell bus	resilience management	BIM	Carbon Usage
PV prosumers	bioenergy villages	offshore	hydrogen mobility	thermal collector	tidal energy	trigeneration	demand response	electric mobility	Mobility as a Service	combustion engines	lighthouse cities	refurbishment	Carbon Sequestration
tandem solar cells	biosensors	wind farm	Power-to-gas	deep geothermal	wave energy	energy storage	energy automation control	charge station system	smart mobility	energy storage	district heating	heating and cooling	CO2 capture

Technology and Business Model Identification from Twitter

Renewable energy			Mobility			Smart living	
Solar energy	Wind energy	Hydrogen power	Electric Vehicles	Mobility systems	Fuel Cells	Smart city	Smart buildings
photovoltaics	wind turbine	hydrogen fuel cells	charging systems	Mobility as a Service	hydrogen fuel cells	smart grids	smart home
PV prosumers	offshore	green hydrogen	lithium-Ion Batteries	autonomous driving	microbial fuel cells	home networking	amazon echo
Tenant electricity	wind farm	Power-to-X	hybrid electric vehicles	smart mobility	hydrogen economy	area-wide LORAWAN supply	google home



Emerging Technology and Business Model Identification

- 154 emerging technologies and business models are identified
- Topic-wise: **renewable energy** is the most popular emerging topic
 - **solar energy** is the most popular emerging sub-topic
 - **hydrogen** is the most emerging sub-topic
- Technology-wise: **AI** and **Big data** appear in every topic
 - **energy storage**, **demand response** and **power warm coupling** are most popular
- Business-wise: **X-as-a-Service** is the most emerging business model, in particular **Solar-as-a-Service** (tenant electricity, prosumer) and **Mobility-as-a-Service**

Conclusion

- Data perspective
 - Twitter is an informative data source to identify emerging technologies and business models
- Methodology perspective
 - Iterative web scraping approach based on keyword extraction
 - Hierarchical Biterm Topic Modeling based on keywords
- Content perspective

Thanks for your questions!

Contact Information

Jiao Jiao

Data Scientist

Competence Center Energy Policy und Energy Market

Fraunhofer Institute for System and Innovation Research ISI

Breslauer Straße 48 | 76139 Karlsruhe

Telefon +49 721 6809-545

<mailto:jiao.jiao@isi.fraunhofer.de>