Analysis, Matching, and Prediction of Data with Time or Space Characteristics according to Association Rule of Data Mining

Wang Yu, Jiang Miinyu, Shao Jialin, Zhang Hongbin, Zhang Pengyu

Fan Gongxiu Hornors College, Beijing University of Technology

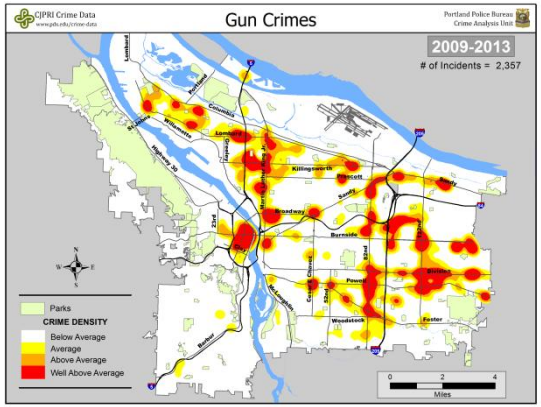
Mentor: Chen Juncheng

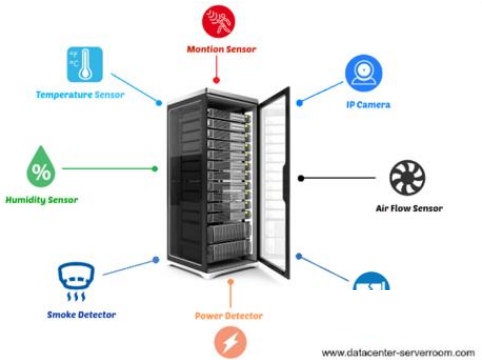
Spatiotemporal = Spatial + Temporal

Mobile Application

Crime Analysis

Environmental Monitoring



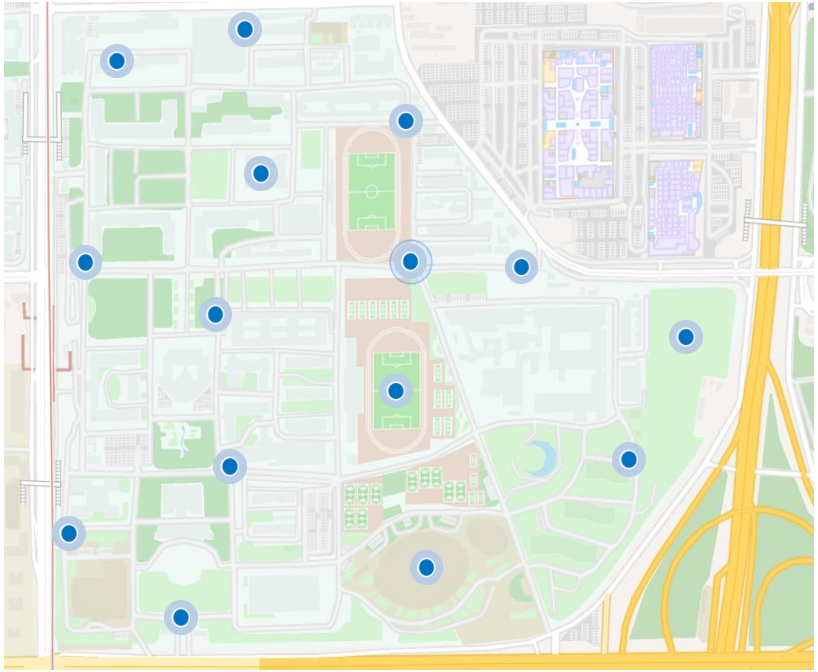


Dynamic Model

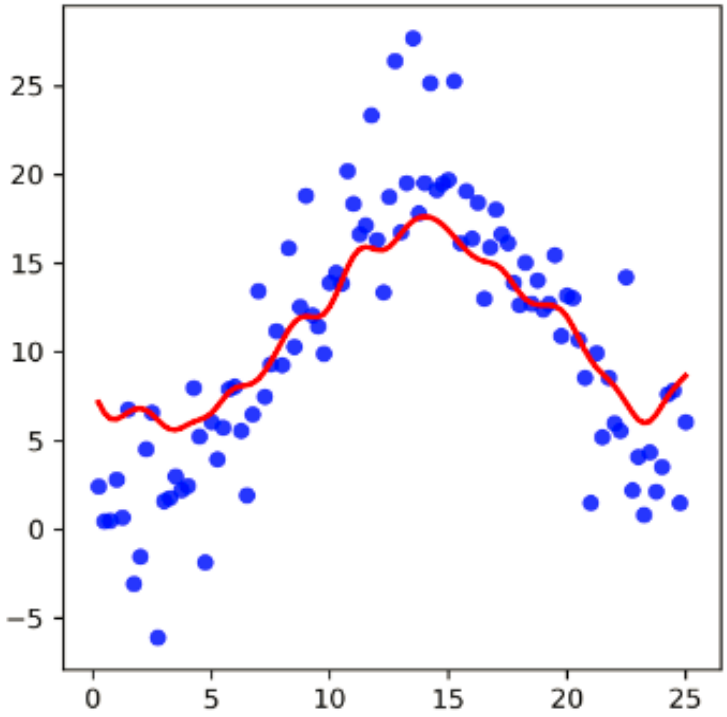
Static Model

[1] https://phys.org/news/2017-11-uber-ipo-ceo.html
[2] https://www.pdx.edu/crime-data/hotspot-past-5-years-11
[3] http://banbenpu.com/picture/server-room-environmental-monitoring-systems-home-design-great-unique-on-server-room-environmental-monitoring-systems-house-decorating/

Application Scene



Static Model



Continuous Temperature

[1] http://map.baidu.com

Key Problem

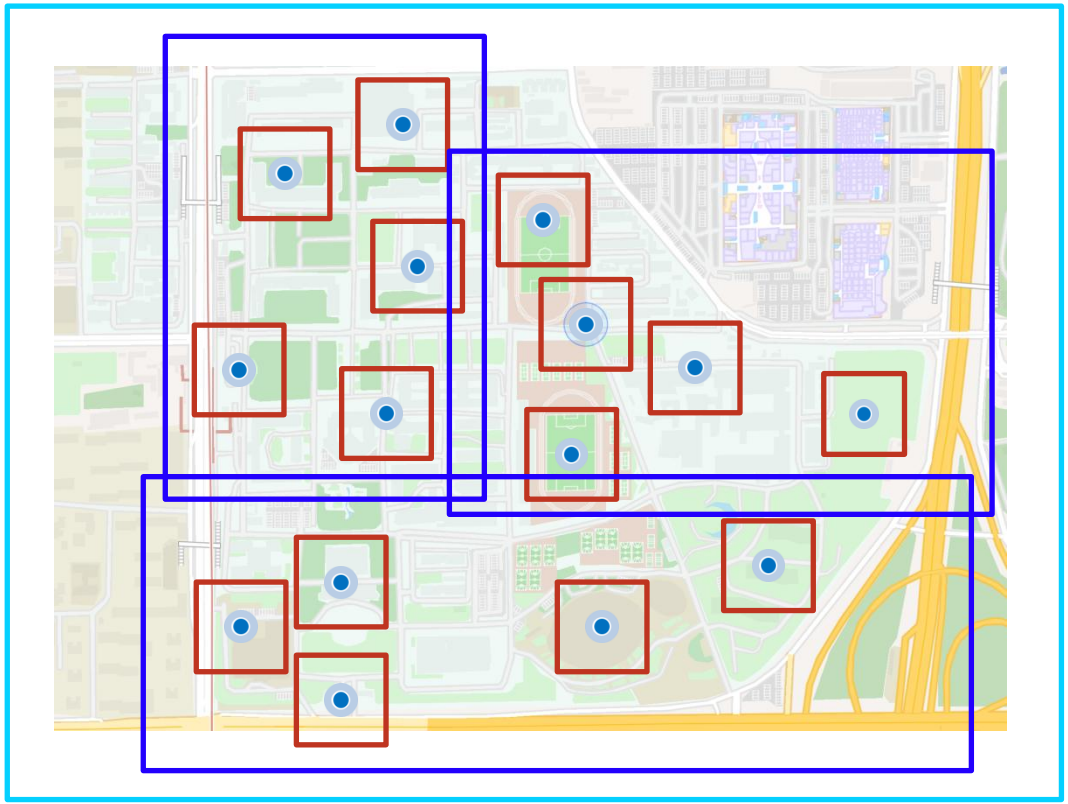
How to build up **index**

for **static** model?

How to realize

continuous query?

Existing INDEX – Rectangle Tree (R Tree)



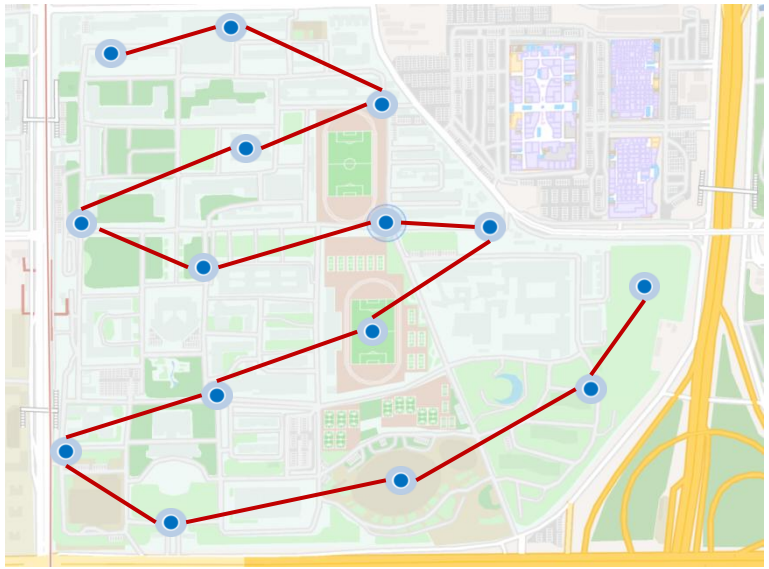
Sensor

- Identifier = Time
- Divide Space = Index

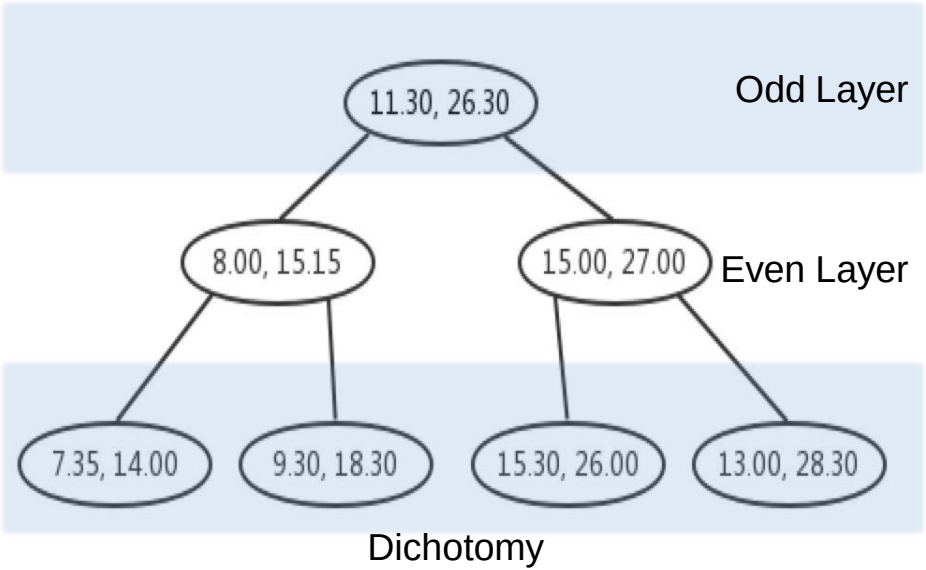
- Low query efficiency in static model

[1] http://map.baidu.com

Our Solution -- K-Dimensional Tree (KD Tree)



Sensor



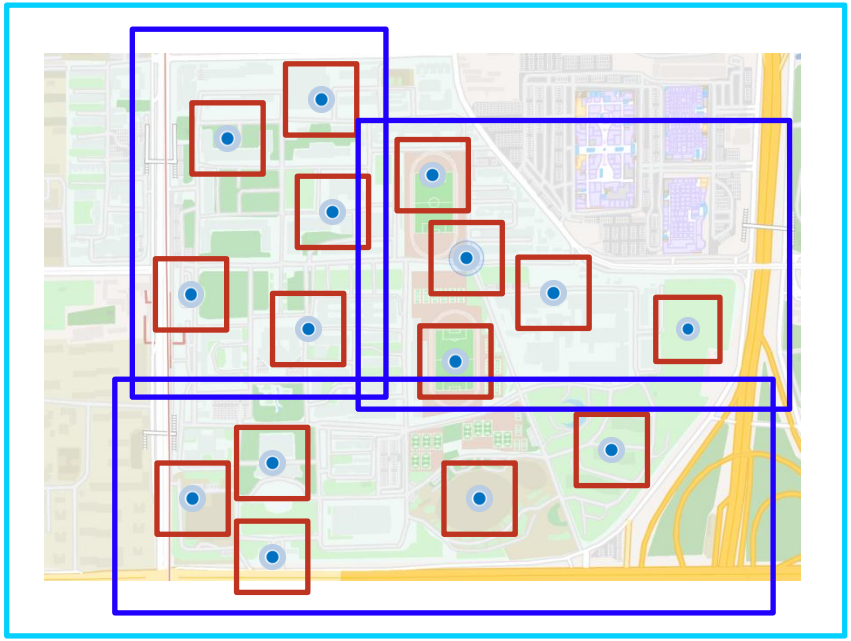
Dichotomy

- Identifier = SensorID (space)
- Divide Time & Temperature = Index

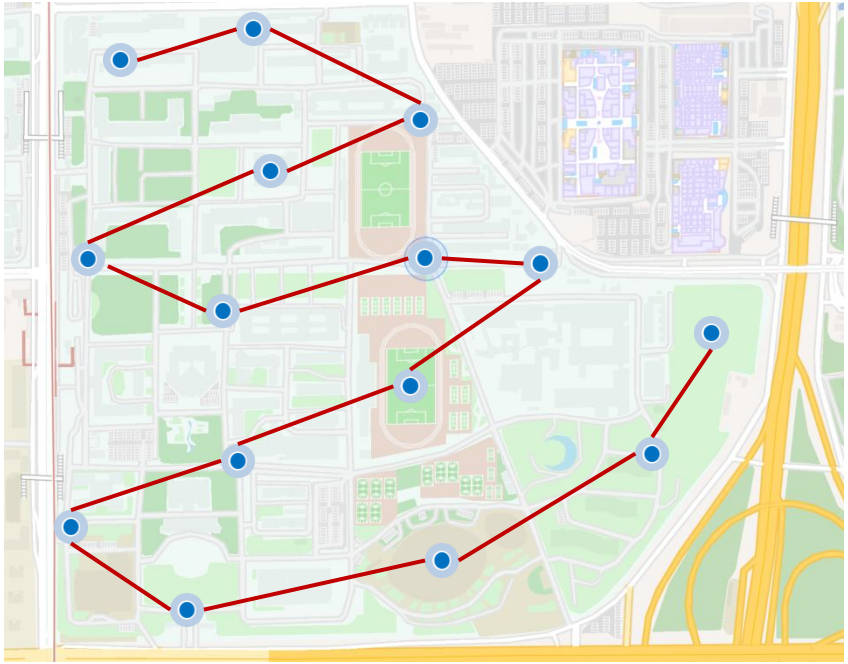
[1] http://map.baidu.com

Tree Comparison

- Lower dimensionality of space characteristic
- Higher query efficiency



Sensor



Sensor

[1] http://map.baidu.com
[2] http://map.baidu.com

Query

A. Moment & Spot
B. Period & Spot
C. Moment & Area
D. Period & Area

Can’t realize continuous query

Our Solution -- Machine Learning

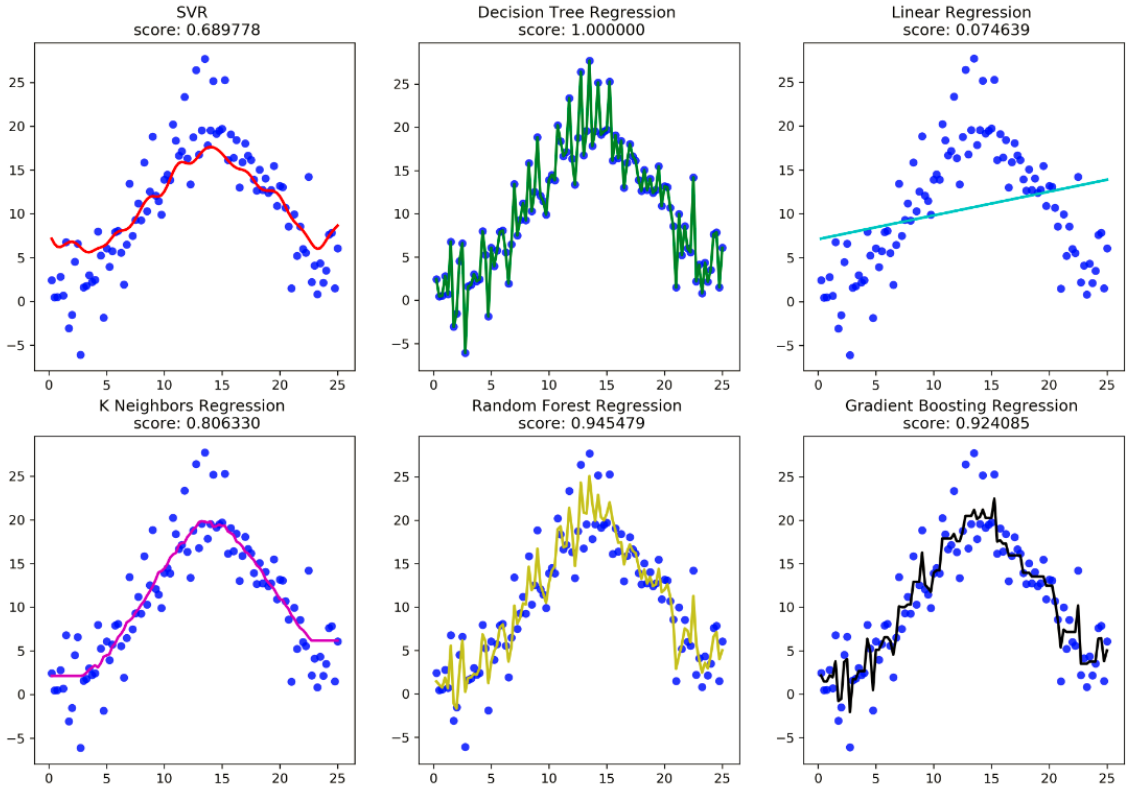


Figure 1 Temperature in a spell at particular location

- Fitting discrete points with 6 machine learning methods.
- Using the evaluation score to choose the most suitable method.

Query B -- Temperature in a Period at a Spot

Continuous query result :

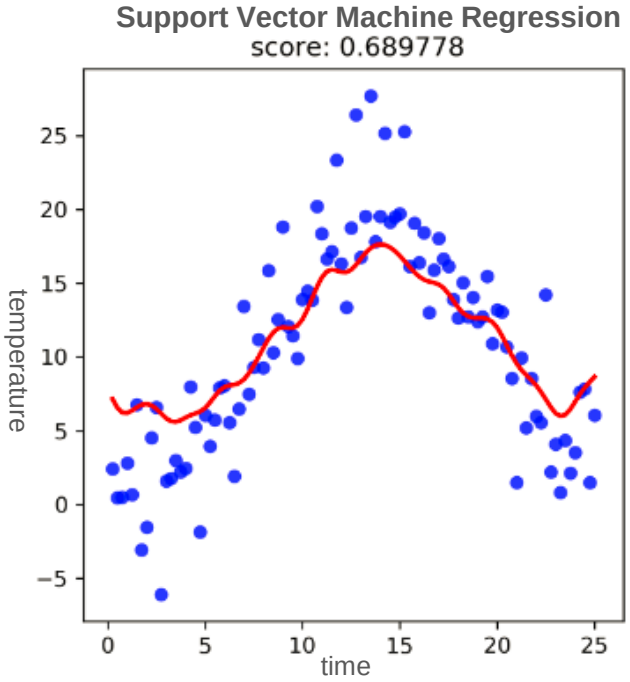


Figure 2 Support Vector Machine Regression
for temperature in a spell at particular location

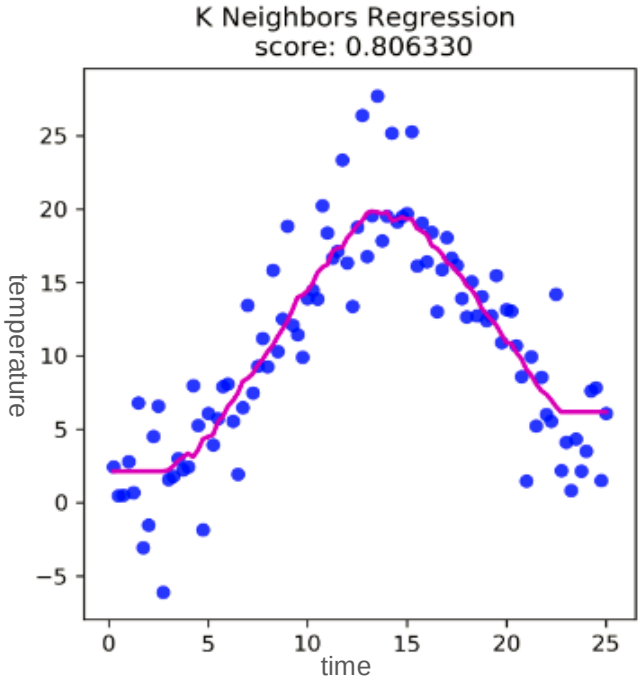


Figure 3 K Neighbors Regression
for temperature in a spell at particular location

Query C -- Temperature of an Area in a Moment

Continuous query result :

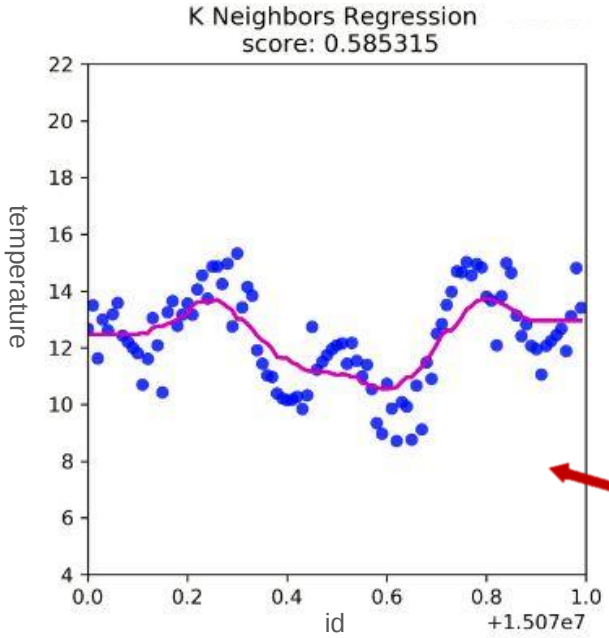


Figure 4 K Neighbors Regression
for temperature in a particular time in areas

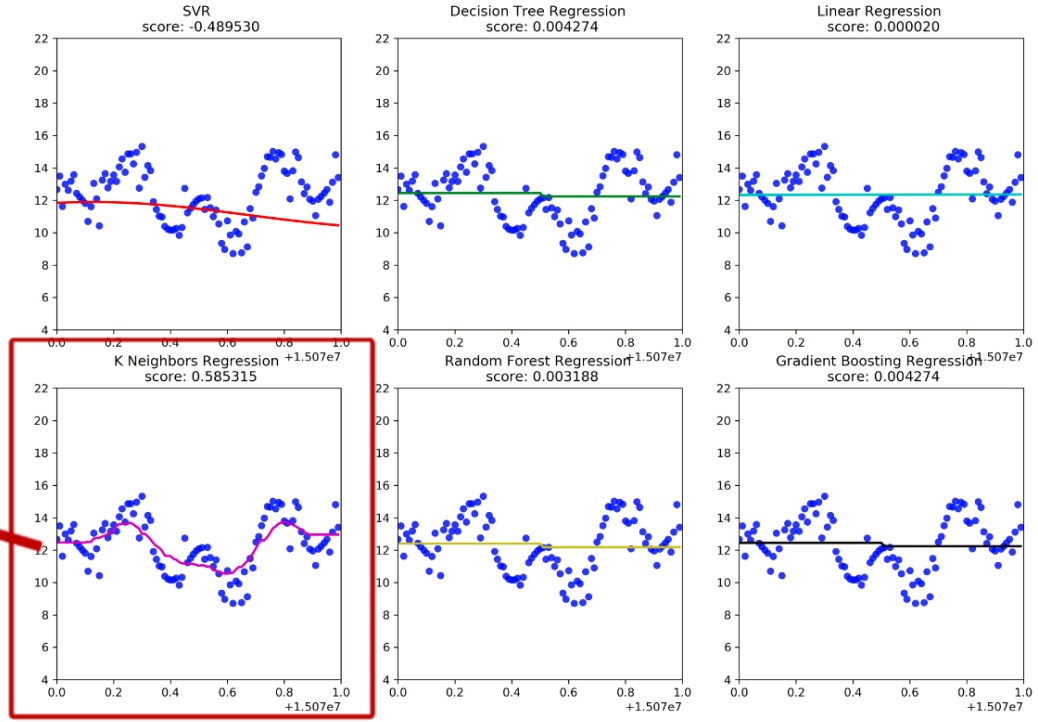


Figure 5 Six regression methods for temperature in a particular time in areas

Query D -- Temperature of an Area in a Period

Continuous query result :

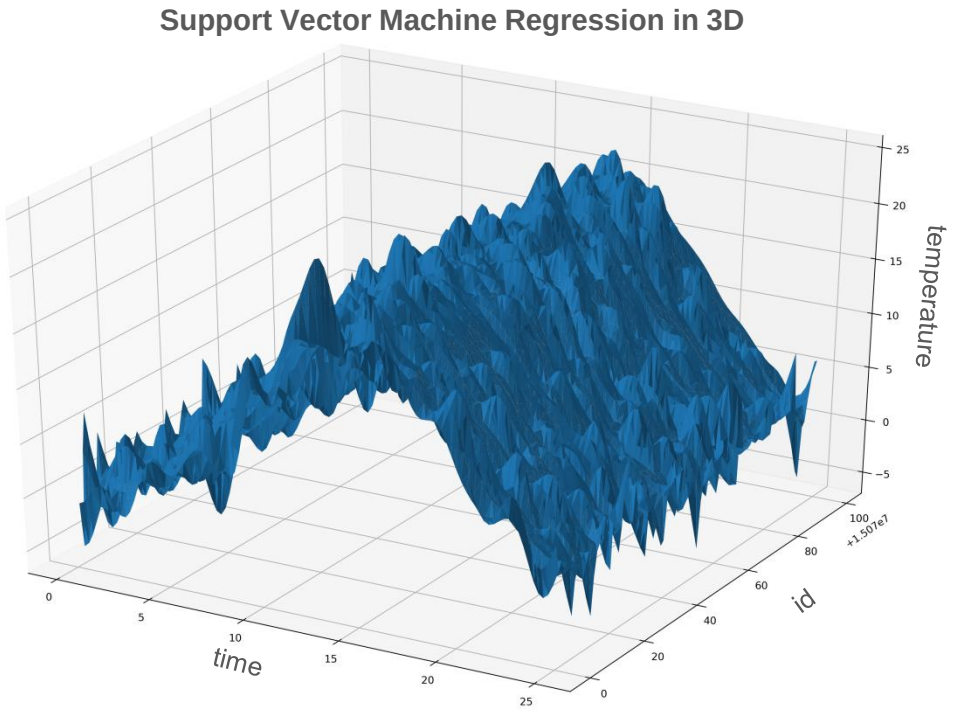
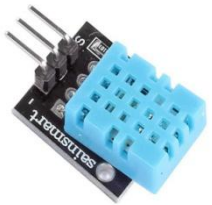


Figure 5 Support Vector Machine Regression for temperature in a spell in areas

- Fitting the 3D data set into hyper plane
- Innovation

(Internet of Things) Data Analysis Platform

Sensor

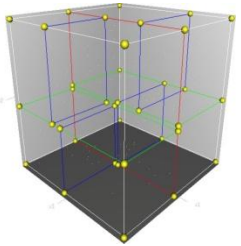


Temperature
Collecting

TCP Module

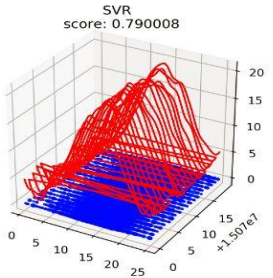
Data Transmission
&
Data Standardization

KD Tree Module



Index
Building

ML Module



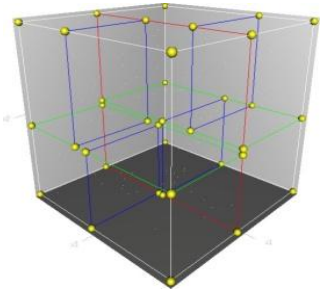
Continuous
Query

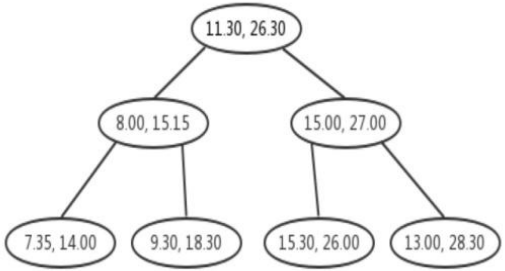
[1] [2] [3]http://map.baidu.com

Live Demonstration

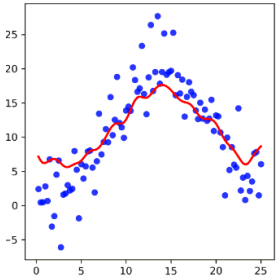
Conclusion

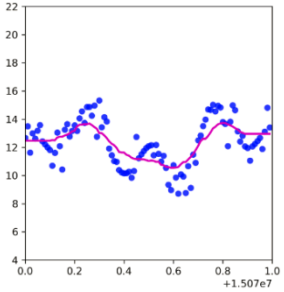
- Index for Static Model – KD Tree

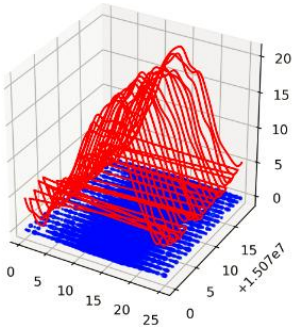


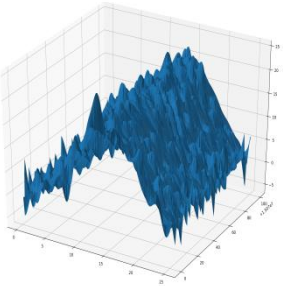


- Continuous Query – Machine Learning









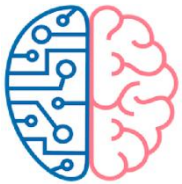
Conclusion

Intelligent Logistics

Intelligent Agriculture

Smart Tourism

Smart City



Intelligent
Medical Treatment

Smart Transportation

[1] [2] [3] [4] [5] [6] https://images.google.com

Thanks for Listening