CITIESData: Towards Cloud Based Big Data Management for Smart Cities

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With the increasing presence of Internet of Things (IoT) and future internet technologies in smart cities, a large amount of data are generated. The data need to be properly managed and analyzed for various application using integrated ICT approach. The ICT technologies for a smart city will deal with the data from different domains, including environmental, energy, transportation and many others. We present a cloud-based ICT platform that can collect, store, share/publish, analyze, and visualize scalable data from city environment.

Smart city data characteristics (5Vs but more Vs are possible):

Methods

The goals:
- Data quality checking and improvement
  - Cleansing data before publishing
- Security and privacy protection
  - Classify data according to different risk levels
  - Using different sharing/publishing strategies

The architecture:
- Apply the virtual machine (VM) based secured environment for using highly sensitive data
- Use the cloud-based data management system, OwnCloud, for semi-sensitive data sharing
- Use the open data platform, Zenodo, for indexing, and sharing

The architecture of big data management system

The process:
- Retrieve duplicate rows
- Do the anonymization
  - Replace household ID with surrogate key
  - Suppress the values of ID attribute, name
  - Generalize the values of QI attribute, address
- Compute the two measures, usageValue and heat/Energy
- Fill missing values
- Store data to OwnCloud
- Publish metadata to Zenodo

Data quality checking model

$$f = \frac{1}{n} \sum_{i=1}^{n} \omega_i y_i + \omega_{n+1} + \omega_{n+2} + \cdots + \omega_{n+k} = 1.0$$ (1)

where $f$ is the overall data quality score, $y_i$ is the data quality of determine attribute $i$, and $\omega_i$ is its weight.

Anonymization methods and software package

CITIES data management system
- A scalable data processing platform
- Data cleaning, analytics and visualization

Results

- We have proposed a smart cities data management framework
- Proposed the method of publishing/sharing data according to different data sensitivity levels.
- Proposed linear regression based data quality checking method
- Implemented a smart cities data platform for streamlining the data management process
- The cities data platform has good performance supporting big data management towards the Cloud

Conclusions

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References