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City Hotspot Identification Using Smart Cyber-Physical Social System

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Abstract
Recently, the concept of smart cities has become popular and got researchers' attention because it helps to improve citizens' lives by providing valuable services, for instance, smart transportation, smart homes, telecommunication, infrastructure, etc. Hotspot analysis is a classic problem concerned with spatial analysis. Telecommunication operators and companies always care to identify the Hotspots in the city. The hotspots are the places with very high communication strength relative to others. It is evident from the current literature that cyber physics social systems (CPSS) are useful in the identification of hotspots in a smart city. However, big data storage, analysis, processing, accuracy, and robustness are the key concerns. Thus herein, we propose a smart cyber-physical-social system for the analysis of hotspots using telecom data. Herein, our proposed CPS model is comprised of three layers and each layer has different functionality. In our proposed model, initially, raw Call Detail Data (CDR) data is collected at the data collection layer. Then smart CPSS passed it to the next layer. In the Data processing layer, CPSS performs pre-processing, data storage, and analysis. Then, it constructs a graph and performs a social network analysis (SNA). Herein, different from traditional centrality measures, we suggest Eigenvector and k-shell as social network similarity and Jaccard, cosine, as social behavioral measures. Herein, the process of city hotspot identification is performed, followed by SNA, which is conducted by quantifying the importance of each hotspot based on metrics. Finally, our proposed smart CPSS model accurately identifies Top-Ten hotspots. In this study, we use five-day data and compare the changes in the hotspot patterns. We validate our findings of hotspots with the original dataset and confirm the robustness and accuracy using autocorrelation and cross-correlation functions.
Keywords: City, hotspot, CPSS, dataset

Introduction

Recently, the concept of smart cities has become popular and got researchers' attention because it helps to improve citizens' lives by providing valuable services, for instance, smart transportation, smart homes, telecommunication, infrastructure, etc. Hotspot analysis is a classic problem concerned with spatial analysis. Telecommunication operators and companies always care to identify the Hotspots in the city. The hotspots are the places with very high communication strength relative to others. It is evident from the current literature that cyber physics social systems (CPSS) are useful in the identification of hotspots in a smart city. However, big data storage, analysis, processing, accuracy, and robustness are the key concerns. Thus herein, we propose a smart cyber-physical-social system for the analysis of hotspots using telecom data. Herein, our proposed CPS model is comprised of three layers and each layer has different functionality. In our proposed model, initially, raw Call Detail Data (CDR) data is collected at the data collection layer. Then smart CPSS passed it to the next layer. In the Data processing layer, CPSS performs pre-processing, data storage, and analysis. Then, it constructs a graph and performs a social network analysis (SNA). Herein, different from traditional centrality measures, we suggest Eigenvector and k-shell as social network similarity and Jaccard, cosine, as social behavioral measures. Herein, the process of city hotspot identification is performed, followed by SNA, which is conducted by quantifying the importance of each hotspot based on metrics. Finally, our proposed smart CPSS model accurately identifies Top-Ten hotspots. In this study, we use five-day data and compare the changes in the hotspot patterns.

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Existing System

Nattapon et al. presented research on CDRs using a telecom dataset.In this study, they propose a method to clean large data using ‘‘filters to filter’ to remove anomalies. Ahmad et al. presented an advanced framework named the churn prediction SNA model. In this model, they combine big data and machine learning.Herein, they suggested various network centrality measures to provide an equality analysis between each node pair. They perform an analysis and hence each node pair interacts with the others using links.

It is evident from the literature that SNA and the centrality measures were used in churn prediction. Modarresi et al.proposed a graph-based analysis model intending to increase the resilience of smart homes.Herein, they suggest several topologies using smart home scenarios. Mededovic et al.explored various centrality metrics and then concluded that they were used in the analysis of hotspots in a certain area.Herein, they performed a detailed analysis using two weeks of telecom data to find the hotspots in the network and also measure the interaction. In this research, they used Eigenvector as a key measure to rank the hotspots. Seufertet al. proposed aWi-Fi hotspot model for the building of a smart city. Herein, the Top-tenWi-Fi hotspot locations were identified using a publicWi-Fi dataset. They concluded that the different Wi-Fi locations can be modeled using auniform distribution. The angles and the gamma distribution can be maintained using minimum distance. This is a very simple Wi-Fi hotspot model and the locations are used to create the spatial distributions.Peiyan et al. presented an advanced data-forwarding method for opportunistic networks. In this research, they explored various sizes of hotspots in the network.

DRAW BACKS :

- In an existing system,the system doesn't implement USEFUL SOCIAL NETWORK SIMILARITY AND SOCIAL BEHAVIORAL MEASURE.
- Social network similarity and behavioral measures not found in an existing system.

Proposed System

The motivation of our research is to propose and develop a smart CPSS model that can efficiently process telecom data and perform data analytics. The proposed CPSS acts as a solution to the challenges associated with the extraction of large-scale data. The hotspots have a high density as compared to the other areas of a city. Thus, hotspot identification is useful to telecom operators and companies to focus only on specific areas in providing high-quality services.The secondary motivation of this proposal is to provide a real-time big data model that will help telecom decision-makers. It is evident from the literature that, telecom operators and companies always take care of providing good services to the customers. As the influential hotspots in a network increase the service-providing features. Thus, it has importance in the telecom domain.• Our proposed CPSS model is smart and comprised of three layers. Each layer has different functionality and hence, different functions have been performed by each layer. Our proposed model initially extracts the hotspots as high-traffic areas from a graph and later performs Social network analytics (SNA). Herein, we suggested social network similarity and social behavioral measures. These measures are used to quantify the importance of each node. Thus, our proposed CPSS model identifies Top-10 high influencers based on suggested metrics and it favors accurate analysis of telecom data.

• In previous studies, traditional centrality methods were used. Our proposed model is unique in all aspects because we have selected social and behavioral measures to detect the hotspots or high communication areas. Thus, it makes our proposed model more efficient. In addition, our proposed CPSS model is efficient because it provides accuracy and robustness which are not supported by the traditional methods.

• In this proposal, we confirmed that social network similarity and behavioral measures are useful in the identification of high communication areas. This will help the telecom operators to perform accurate analysis of large-scale telecom data.

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ADVANTAGES :

• This research provides big data analysis using telecom data. Thus, it helps the telecom operators and the companies to identify the hotspots (high communication areas) in a smart city. It has a benefit for the telecom companies so that they can pay more attention to these areas in providing more good services in target areas.

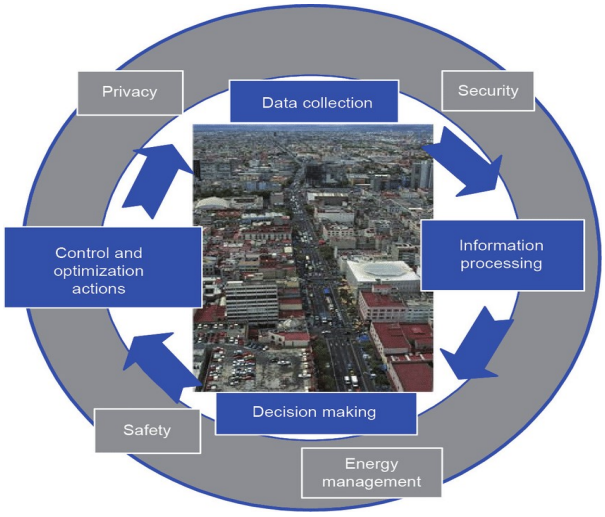
• The proposed CPSS model is smart because it helps to identify the high communication areas in a smart city.

• In this proposal two research fields can be combined, i.e. Graph theory and communication.

Results

I understand you're seeking screenshots for a Java project on "City Hotspot Identification Using Smart Cyber-Physical Social Systems." While specific screenshots for this exact project are not readily available online, I can guide you on how to obtain or create them.

While not identical, similar projects may provide visual insights. For example, a Smart City Java project offers modules like Industries, ATM Location, and Travel, which might include relevant screenshots:



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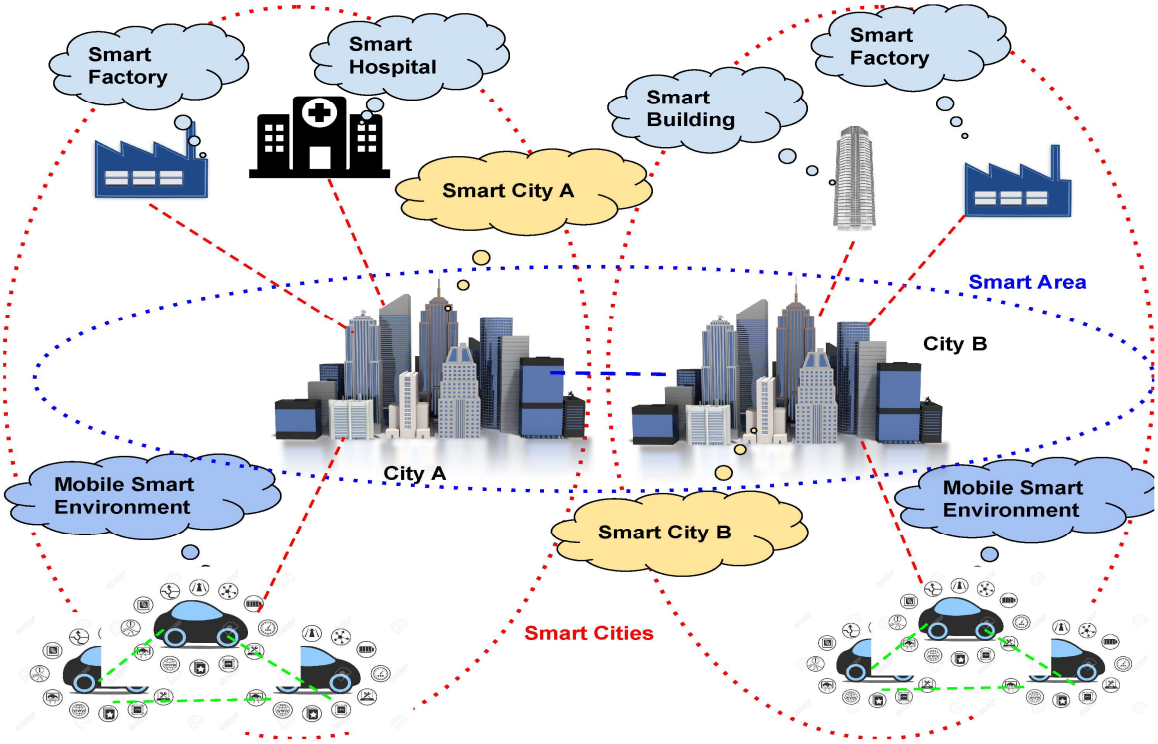
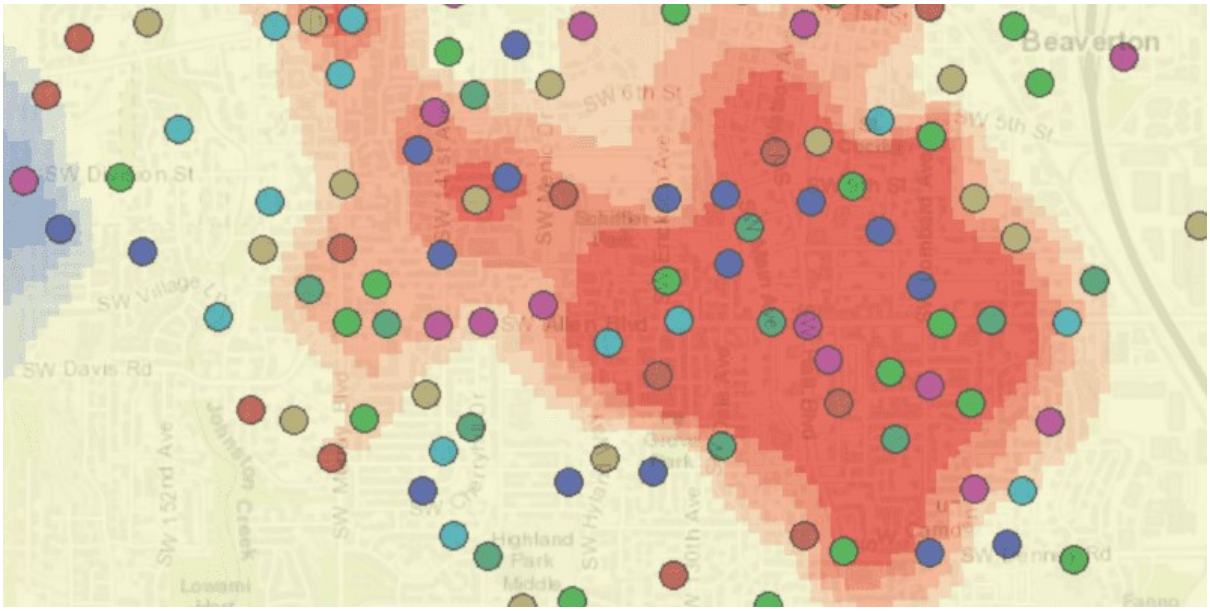


Analyze hotspots



Identifying Topical Hot Spots in Urban Areas

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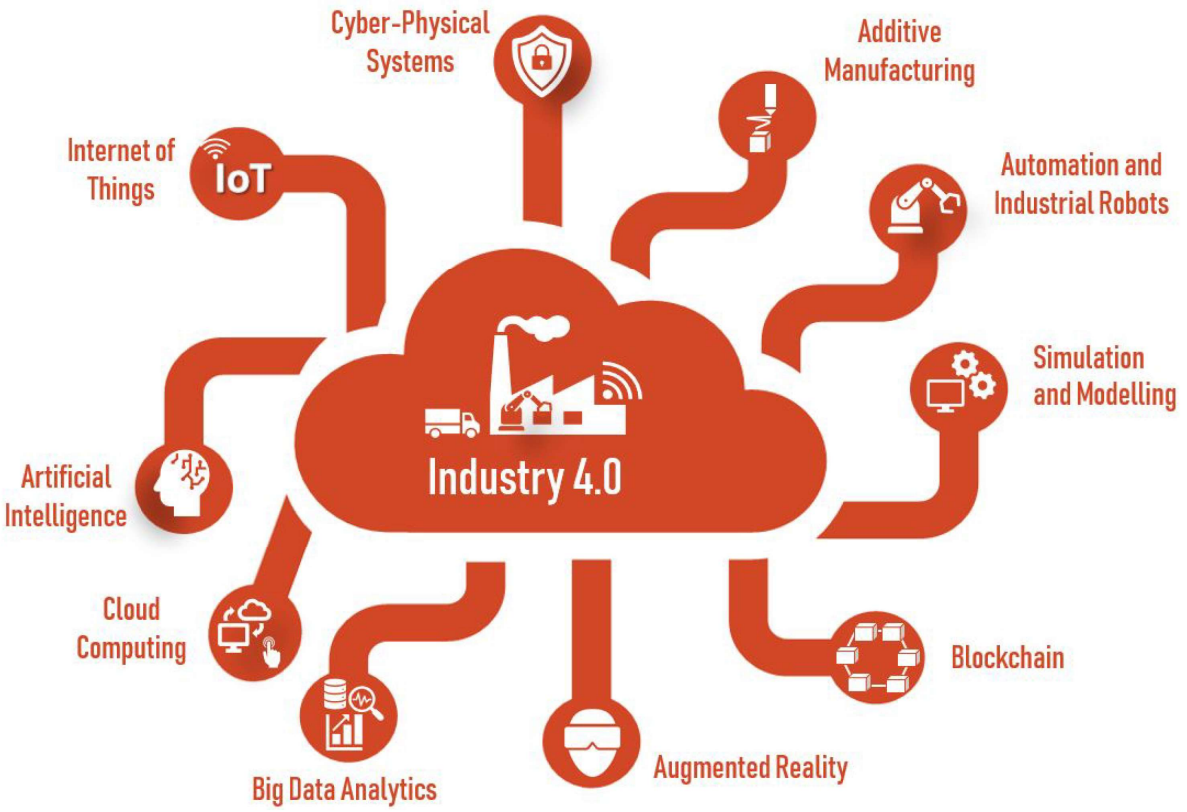
Design of a Smart Factory Based on Cyber-Physical Systems and Internet of Things towards Industry 4.0



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As today's markets are being reshaped by groundbreaking technologies, there is more pressure on the industry to become more flexible and adaptable in order to meet the changing needs of markets. With more competition in efficiency, productivity, and quality in the global market, companies need to make big changes to their production plans, technologies, and management.Thanks to technological advancements, many different industries have been able to boost their performance and productivity through the use of automation, digitalization, and artificial intelligence, as well as the unprecedented availability and affordability of computing power, smart sensors, data acquisition systems, intelligent robotics, information and communication technology (ICT), the introduction of the Internet of Things (IoT), Big Data, and cloud computing.

Conclusion

Herein, we proposed a smart CPSS model on a big data platform by using telecom data. The smart CPSS model is divided into different layers and each layer has different functionality. At first, the data collection layer receives raw telecom data. The next step is to pass through the data processing layer. The data processing layer performs different functions, for instance, processing, storage and analysis, etc. Then, it constructs a graph and performs a social network analysis (SNA). Herein, the high communication areas in a city were identified and secondly, Top-10 hotspots were discovered using social network similarity and social behavioral measures. It is evident from the results that our proposed big data analysis has shown that the ranking of hotspots remains practiced under these metrics. In addition, we found that the variance of results is significantly smaller for Milan. This research is helpful the traffic forecasting. In the future, will perform a detailed analysis of the complete dataset that comprises every week's data for Trento.

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