NSF Spatiotemporal Innovation Center August/September 2020 Monthly Newsletter

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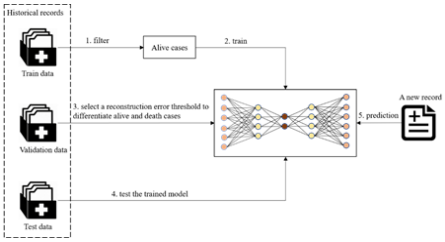

Individual-Level Fatality Prediction of COVID-19 Patients Using AI Methods

In the months since COVID-19 has progressed to become a global pandemic, the virus has plagued over hundreds of countries and has affected not only the individuals who have contracted the infection, but also healthcare employees and patients with illnesses unrelated to COVID-19. Due to the severity of some COVID-19 cases, many individuals have progressed to ICU admission which inflicts enormous stress on healthcare workers in hospitals that lack sufficient equipment or are operating at full capacity. As a result, there has been an increase in demand to accurately identify patients who, given their present state when tested positive for COVID-19 and medical background, are identified as high-risk cases. This way, hospitals can identify patients with high priority and save more lives since priority treatment can be given to individuals at higher risk of fatality. This project addresses the demand for identifying such individuals by adopting a deep learning model to accurately predict individual fatality given the patient's underlying health conditions, age, sex and other factors. After careful data preprocessing and training, the model was able to predict whether a positively-tested COVID-19 patient was likely to survive given their medical information and disposition. As the allocation of resources towards vulnerable patients can mean the difference between life and death, this prediction model is an immensely valuable tool to helping healthcare workers prioritize resources and hospital spaces. Read More

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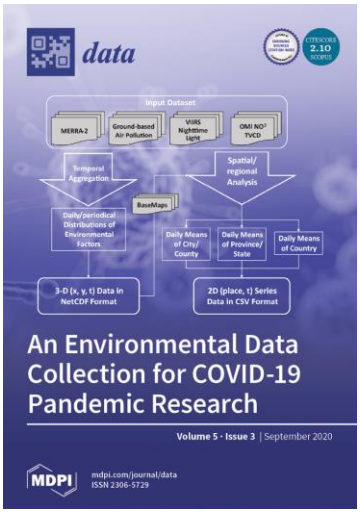

An Environmental Data Collection for COVID-19 Pandemic Research

This data descriptor paper introduces a collection of environmental factors, including temperature, humidity, precipitation, NO_2 TVCD, air quality index and pollutants and nighttime light. The environmental data are processed and organized across multiple spatiotemporal scales using spatiotemporal aggregation and analytics, e.g., global mapping of daily temperature, humidity and precipitation, daily mean values of climate and weather factors over cities, states/provinces and countries. The data collection can be used for studying the correlation between COVID-19 and the environment, as well as human activities; for example, how the climate/weather conditions slow down or speed up the spread of the pandemic and how COVID-19 mitigation policies impact environmental factors. Read More

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Hyperspectral Infrared Sounder Cloud Detection Using Deep Neural Network Model

This project has developed a new cloud detection model for the cross-track infrared sounder (CrIS) using artificial deep neural network (DNN) techniques, using datasets collected from the Visible Infrared Imaging Radiometer Suite (VIIRS). The training dataset is built from CrIS-VIIRS collocated measurements randomly selected from different months to more accurately represent the range of different atmospheric and surface conditions. The proposed CrIS detection of cloud-contaminated field of views (FOV) from satellite hyperspectral infrared sounders is essential for numerical weather predictions, and has resulted in high model accuracy levels of 93%. The model is more accurate during the daytime than the nighttime, with accuracy values of 94% and 91% respectively. The model also has a higher cloud detection accuracy within ocean areas than continental land, with accuracies of 95% and 88% respectively. Future work on the model includes eliminating falsely detected pixels over snowy, icy, and desert areas, as well as refining the model to be able to better distinguish thin clouds from clear skies. Read More

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Data Migration and Maintenance

Data migration and maintenance is a platform, which was created for the sole purpose of making published research more accessible to researchers across the world. To accomplish this, the following sequence of activities must be accomplished by the project team: interactions to further analyze and understand the code, arrange a GitHub repository for each research project, migrate the source code as well as results to the repository, create a comprehensive user guide that explains the research work, validate the code, create a tutorial video, upload to Youtube, and provide the link within the user guide, and finally revise the practicality of the user guide. To this date, the project team has completed three publications on environmental issues and one on planetary defense research work in the Github Repository. Read More

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STC-20-02 Spatiotemporal Analytics of COVID-19's Second-Order Impacts on Global Vulnerable Urban Areas

This project addresses the role of spatiotemporal data, including open data, upon the understanding and mitigation of impacts from the COVID-19 pandemic. With new migration patterns, a collapse of informal economies, a lack of resources and access to adequate healthcare services, and overcrowded informal settlements, development backsliding during the COVID-19 pandemic poses a high risk for developing countries and rapidly growing cities. By examining the potential long-term and second-order impacts of COVID-19 and the responses enacted at various scales, from multinational regions to neighborhood-level ones, this project aims to facilitate discussion and inform participatory mapping and open data creation to help mitigate the second-order impacts of COVID-19 in vulnerable communities.

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Updates: Harvard-19-01 CDL: Developing an Online Spatial Data Sharing and Management Platform

The China Data Lab (CDL) is currently deploying its SDL (Spatial Data Lab) platform on the new server at Harvard University. This will dramatically promote computing and storage capability for research and education on the cloud. Additionally, the research team has been creating new workflows to generate dynamic maps for web visualization and to replicate models in published papers to promote data and knowledge sharing, research collaborations, and data applications in research and education. The team has been supporting IAB members in organizing Monthly Training Webinars on Research Data Sources, Tools, and Applications since September 24, 2020. Read More

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