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DATA SCIENCE

Changepoints During COVID-19

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TELLING THE COVID-19 STORY

The COVID-19 pandemic is a unique, ongoing event in world history that scientists, doctors, and various professionals are all trying to comprehend in their respective domains. In this project, we as data scientists, make sense of the events during the pandemic with a machine learning approach of changepoint detection. A changepoint is defined as a 'persistent change' in a time series. Meta's Infrastructure Data Science team has released a time-series package called KATS which implements multiple changepoint detection algorithms (Cumulative Sum Detector, Bayesian Online Changepoint Detector, Robust Stat Detector) and tries to identify points in a time-series which show a sudden or abrupt change. We have examined, evaluated, and applied these algorithms to the Google Mobility dataset to understand the effects of key events during the pandemic.

CHANGEPOINT ALGORITHM SELECTION

Timeseries	CUSUM	BOCP	RS
Multiple CPs		✓	✓
Known CP Direction	✓		
No Domain Knowledge		✓	
Seasonality		✓	
Outliers	✓		✓
Few Datapoints	✓		✓

CP: Changepoint
CUSUM: Cumulative Sum
BOCP: Bayesian Online Changepoint
RS: Robust Stat

CATALYST EVENTS AND THE OBSERVED EFFECTS

Over the course of the COVID-19 pandemic, there were catalyst events which mark the true changepoints in this experiment. The effects of these events are modeled as detected changepoints in the time series.

EVENT: CDC recommends restrictions on large gatherings, 3/15/2020
CHANGEPOINT: Sharp decrease in retail and recreational activities, 3/19/2020

EVENT: CDC recommends facial coverings, 4/3/2020
CHANGEPOINT: Recovery of retail and recreation, 4/3/2020

EVENT: Large scale distribution of vaccines, 2/1/2021
CHANGEPOINT: Start of sustained increase in retail and recreation, 3/5/2021

EVENT: Omicron variant detected, 12/1/2021
CHANGEPOINT: Sharp, continued dip in retail activity, 1/1/2022

CHANGE IN MOBILITY: RETAIL AND RECREATION IN THE UNITED STATES