Understanding Drought Awareness from Web Data - A Computer Vision Approach

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Abstract

We used computer vision (U-Net) model to leverage Standardized Precipitation Evapotranspiration Index (SPEI), Google Trends Search Interest, and Twitter data to understand patterns with which people in Continental United States (CONUS) indicate awareness of and interest in droughts. We found significant statistical relationships between the occurrence of meteorological droughts, as measured by SPEI, and search interest on drought topics over CONUS. SI tends to lag meteorological drought by a period of 2-3 months, however relationships between meteorological drought and corresponding search interest varies significantly over CONUS in both space and time. People in states with increasingly drier conditions generally have become increasingly interested in drought topics. However, with worsening drought conditions in California, public search interest on drought topics in the state has not increased significantly between 2016 and 2020, despite the overall search interest being high. We additionally applied sentiment analysis on 5 million tweets related to droughts and found that public emotions towards drought have become more polarized over time.
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- Do people respond to droughts by searching drought terms on Google and is there a lag?
- Does the relationship between droughts and people’s search interest vary over place?
- Have people in drought hotspots become increasingly interested in droughts?
- Does the relationship between droughts and people’s search interest vary over place?
- Distribution of best lag models over CONUS
  - 2 and 3 months lagged were the best performing models

UNet Model
- 6 UNet models trained on lagged SPEI data
- Significant nonlinear correlations found
- The 2 months and 3 months lagged models performed best

- Model performance (averaged over all models) per pixel over test period (2017-2020) was plotted
- Significant spatial variability in performance was observed
- Nonlinear correlations visualized

- Search interest has generally risen in states with increasingly dry conditions!
- Search interest is more correlated to droughts in states where droughts are comparatively recent (as indicated by USDM and various other data sources)

Future Directions
- Understanding the underlying mechanisms of change
- Computer vision based global drought prediction models

Sentiment Analysis of Tweets

For California, with increasingly dry conditions, search interest did not increase recently!

Interested in learning more? Scan the QR code for a link to our paper or email me: mashman@ucdavis.edu