Title page

Thesis title

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Abstract

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Contents

List of Figures

List of Tables

List of Acronyms

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1 Introduction

In early twenties, floods around Lake Vänern and Arvika have costed Sweden an estimate of 11.1 billions Swedish Krona for damages and repairs [7]. Counties of Dalarna and Gävleborg has suffered from flash floods in 2021 disturbing the daily life of their citizens and damaging public and private properties [3]. Flooding is a devastating natural disaster that threatens the lively hood of people and the infrastructure of communities around the world [5].

To facilitate the process of emergency management during these hazardous events, early warning systems analyze their risk, monitor and warn the public while ensuring their readiness [2]. Traditionally, meteorologists forecast the weather by relying on tools such as gauges, satellites, and radars for data extraction. The emergence of social media platforms such as twitter provide individuals a public space to share their experience, effectively creating another potential source of data.

Researchers started harnessing this new wealth of information to aid the disaster management procedure. Twitter's stream API makes it possible to create a monitoring system for early event detection on a global [4] and local [1] scales. Another use for it would be identifying victims in real time, locate their physical location, and communicate the information to rescue teams [8]. After the threat subsides, emergency managers can use relevant tweets to assess the impact and plan the recovery phase [1]. To prepare for future floods, authoritative entities can make informed actions by analyzing historical data and determine the locations suffering from recurrent calamity. This new acquired knowledge is able to augment weather warning systems' pipelines improving their accuracy [6].

This thesis project implements a pipeline that provides a visual representation of tweets related to flood events in Sweden. First, relevant tweets are pulled, processed, and classified from the twitter API using data mining techniques. Second, physical locations are extracted from tweets mentioning flood events employing Named-entity recognition (NER) and gazetteer. Finally, the identified locations with relevant information from tweets are presented on a spatio-temporal visualization. For verification purposes, the pipeline is applied on a week worth of tweets after past flood events.

References

[1] J.L.P. Barker and C.J.A. Macleod. "Development of a National-Scale Real-Time Twitter Data Mining Pipeline for Social Geodata on the Potential Impacts of Flooding on Communities". In: *Environmental Modelling & Software* 115 (May 2019), pp. 213–227. ISSN: 13648152. DOI: 10.1016/j.envsoft.2018.11.013. URL: https://linkinghub.elsevier.com/retrieve/pii/S136481521830094X (visited on 09/07/2022).

[2] Wikipedia contributors. *Early Warning System*. In: *Wikipedia*. 1119015319th ed. Wikipedia, The Free Encyclopedia, 10/30/2022, 06:41:00 AM. URL: https://en.wikipedia.org/w/index.php?title=Early_warning_system&oldid=1119015319 (visited on 11/17/2022).

[3] Richard Davies. *Sweden – Flash Floods in Dalarna and Gävleborg After Record Rainfall*. FloodList. Aug. 19, 2021. URL: https://floodlist.com/europe/central-sweden-floods-august-2021 (visited on 11/17/2022).

[4] Jens A. de Bruijn et al. "A Global Database of Historic and Real-Time Flood Events Based on Social Media". In: *Scientific Data* 6.1 (1 Dec. 9, 2019), p. 311. ISSN: 2052-4463. DOI: 10.1038/s41597-019-0326-9. URL: https://www.nature.com/articles/s41597-019-0326-9 (visited on 10/04/2022).

[5] *Floodlist*. FloodList. Aug. 19, 2021. URL: https://floodlist.com/europe/central-sweden-floods-august-2021 (visited on 11/17/2022).

[6] Tina Neset. *AI4ClimateAdaptation*. Linköping University. URL: https://liu.se/en/research/ai4climateadaptation (visited on 11/18/2022).

[7] *River Floods Sweden*. ClimateChangePost. Nov. 6, 2022. URL: https://www.climatechangepost.com/sweden/river-floods/ (visited on 11/17/2022).

[8] Jyoti Prakash Singh et al. "Event Classification and Location Prediction from Tweets during Disasters". In: *Annals of Operations Research* 283.1 (Dec. 1, 2019), pp. 737–757. ISSN: 1572-9338. DOI: 10.1007/s10479-017-2522-3. URL: https://doi.org/10.1007/s10479-017-2522-3 (visited on 09/07/2022).

Appendices

A Dummy appendix

A.1 Dummy appendix