AI for Climate Adaptation

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Project Partners

LINKÖPING UNIVERSITY

TEMAM / iVis

SMHI

Swedish Meteorological
and Hydrological Institute

LÄNSSTYRELSEN
ÖSTERGÖTLAND

The county board of Östergötland

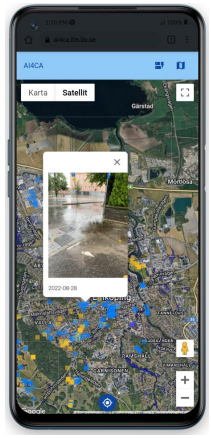
VINNOVA

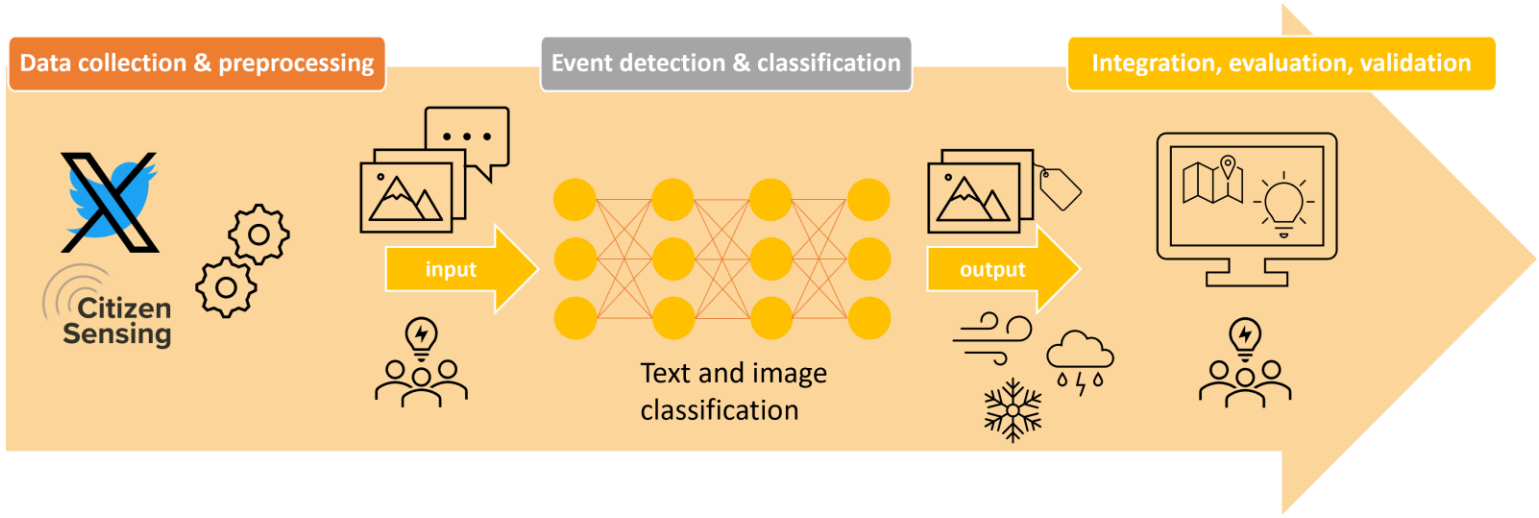
Nov 2020 – Maj 2024

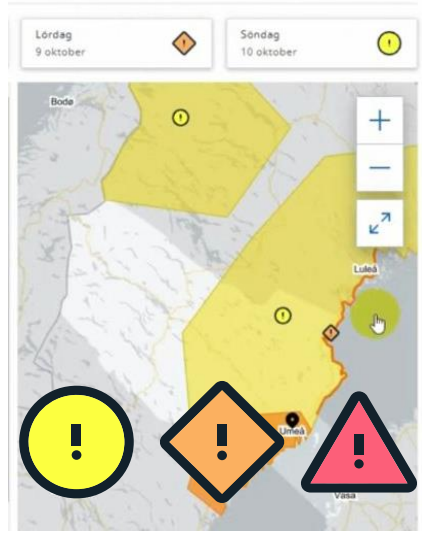
AI for Climate Adaptation

AI for climate adaptation explores the potential of AI-based image and text classification of Volunteered Geographic Information (VGI) to contribute to the evaluation of the accuracy of the SMHI national system for impact-based weather warnings

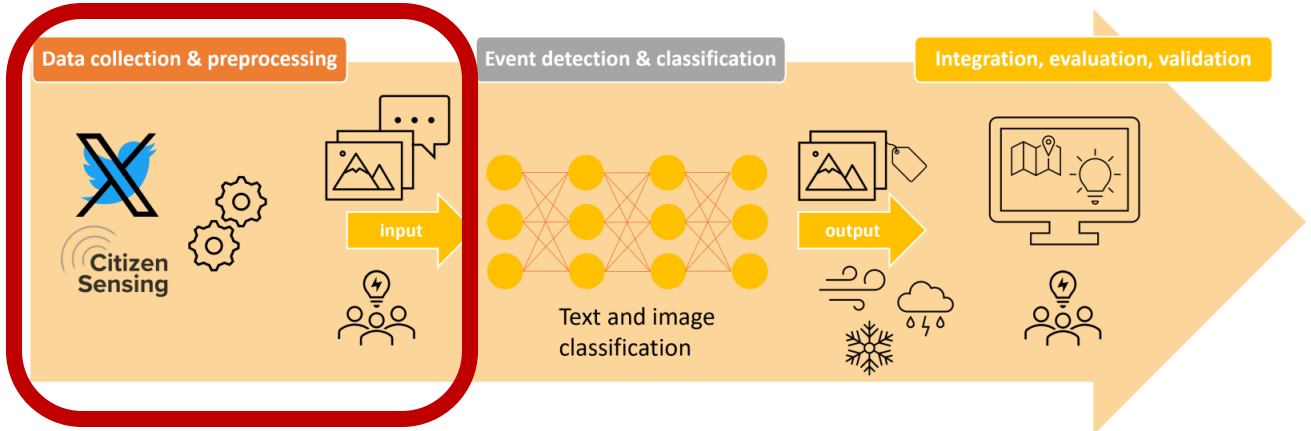
AI for Climate Adaptation - pipeline







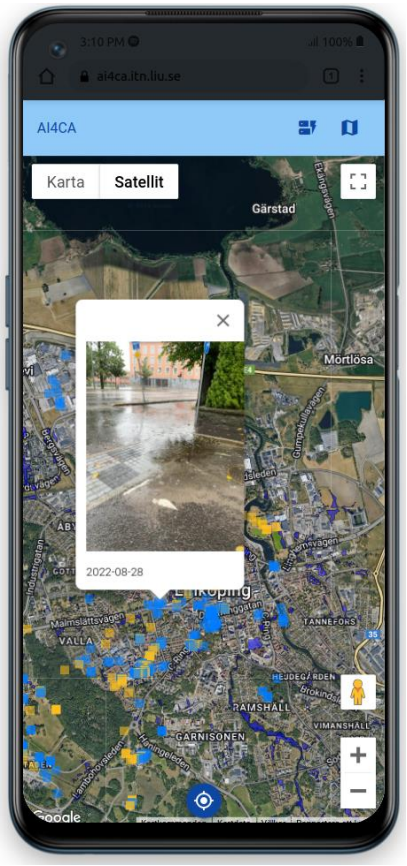
Data collection & preprocessing



- Collected datasets – Twitter/X
- Mobile app for data collection – images & annotations

AI4CA app


3:10 PM
100%
ai4ca.itn.liu.se
AI4CA
Passcode
Vad skulle du vilja rapportera?
Översvämmat område
Vad syns i bilden?
Asfalterad yta
Den observerade översvämningen:
Hindrar framkomligheten i viss utsträckning


3:10 PM
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AI4CA
Karta
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Gärstad
Mortlösa
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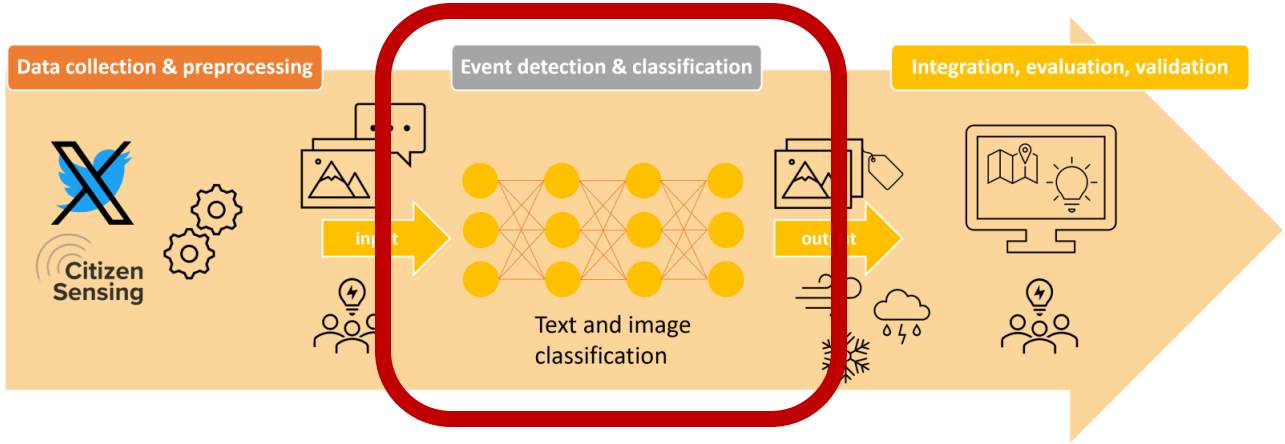
VALLA
RAMSHÄLL
GARNISONEN
VIMANSHÄLL
TANNEFORS
Google

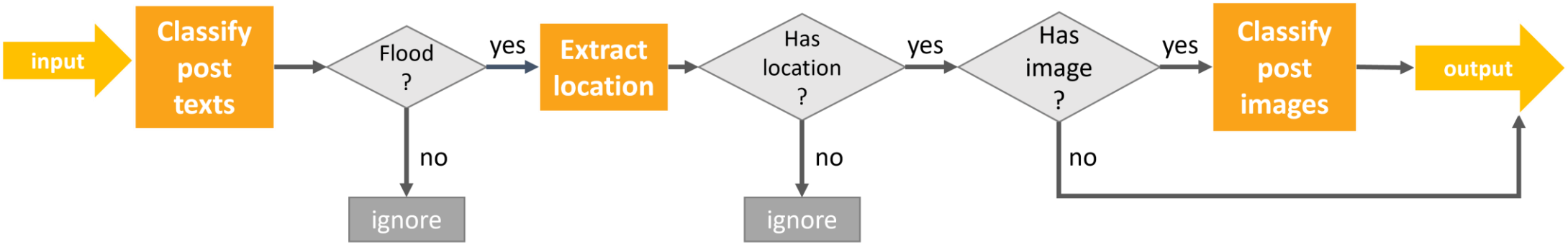
Event detection & classification



- Text classification
  - Bert based model
- Image classification
  - Vision Transformer
  - Semantic Segmentation

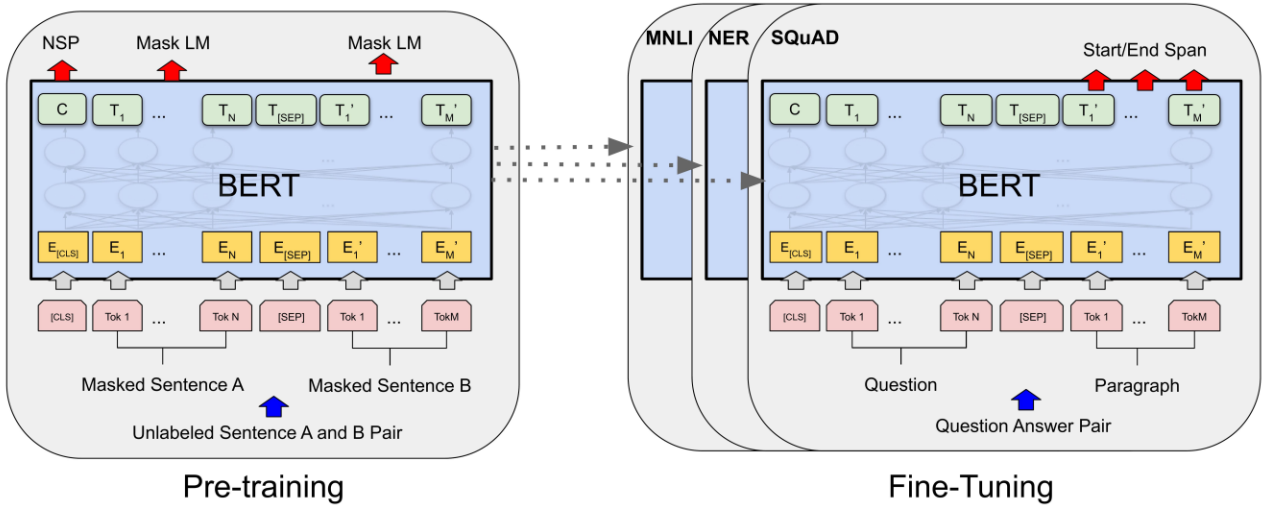
Event concentration of flood-related texts/images over time

Data processing pipeline

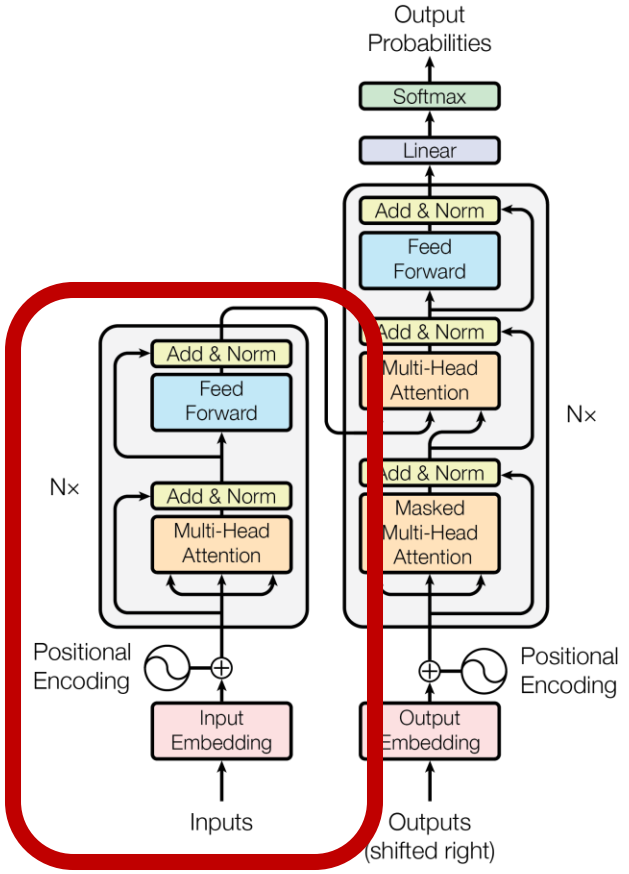


Text classification – Bert model

- DistilBERT Model



Devlin, Jacob. "Bert: Pre-training of deep bidirectional transformers for language understanding." (2018).



Encoder Decoder

Attention Is All You Need

Vaswani, A. "Attention is all you need." Advances in Neural Information Processing Systems (2017).

Text classification – Fine-tuned data

CrisisLexT6 Tweets from 6 crises, labeled by relatedness June 2014

This collection includes English tweets across 6 large events in 2012 and 2013, with about 10,000 tweets labeled by relatedness (as "on-topic", or "off-topic") with each event.

List of crises included »

- **Contents**: ~60K tweets posted during 6 crisis events in 2012 and 2013.
- **Sampling method**: ~10 million tweets in total sampled by keywords and geographical regions or coordinates. Tweets were provided by Twitter's partner Topsy (4 geo-based), or as lists of tweet ids by Twitris v3 (5 keyword-based datasets, thanks to Hemant Purohit) and Twitter's partner GNIP (1 keyword-based, 2 geo-based, thanks to Aron Culotta) .
- **Labels**: ~60,000 tweets (10,000 in each collection) were labeled by crowdsourcing workers according to relatedness (as "on-topic", or "off-topic").
- **Data format**: comma-separated values (.csv) files containing the text of the tweets and labels for the labeled ones.

If you use the CrisisLexT6 collection, please cite:

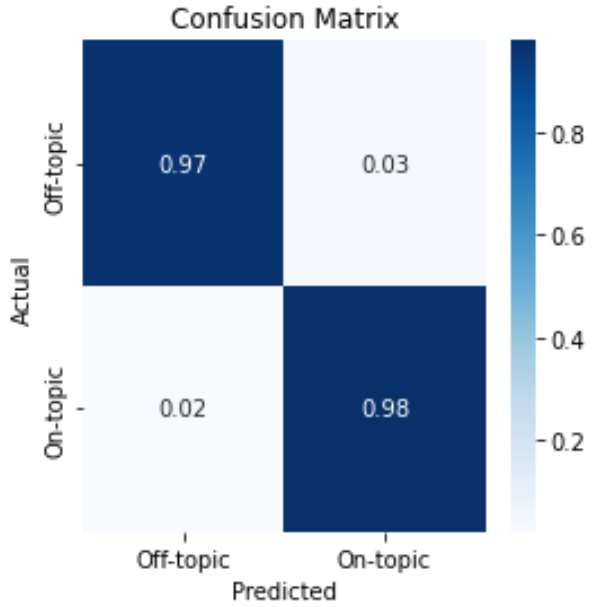
- A. Olteanu, C. Castillo, F. Diaz, S. Vieweg. 2014. CrisisLex: A Lexicon for Collecting and Filtering Microblogged Communications in Crises. In Proceedings of the AAAI Conference on Weblogs and Social Media (ICWSM'14). AAAI Press, Ann Arbor, MI, USA.

Browse on GitHub | CrisisLexT6-v1.0.zip (3.1 MB)

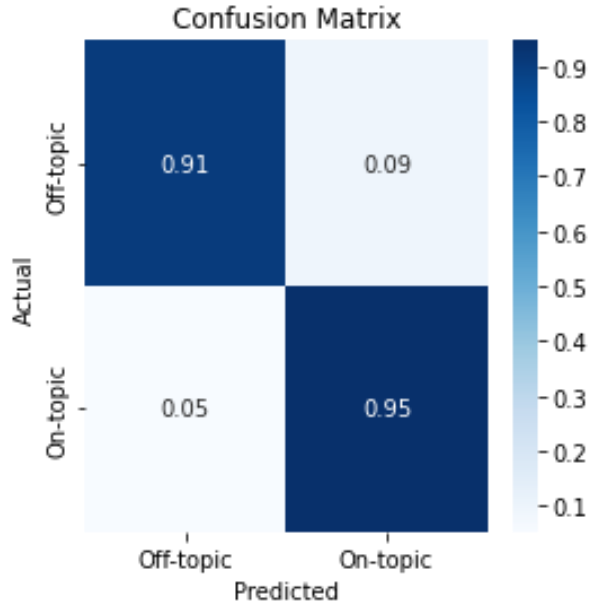
- The Queensland floods – January/February 2013
- Alberta floods – June/July 2013

Text classification

- DistilBERT Model
- Fine-tuned with:
  - CrisisLex twitter dataset

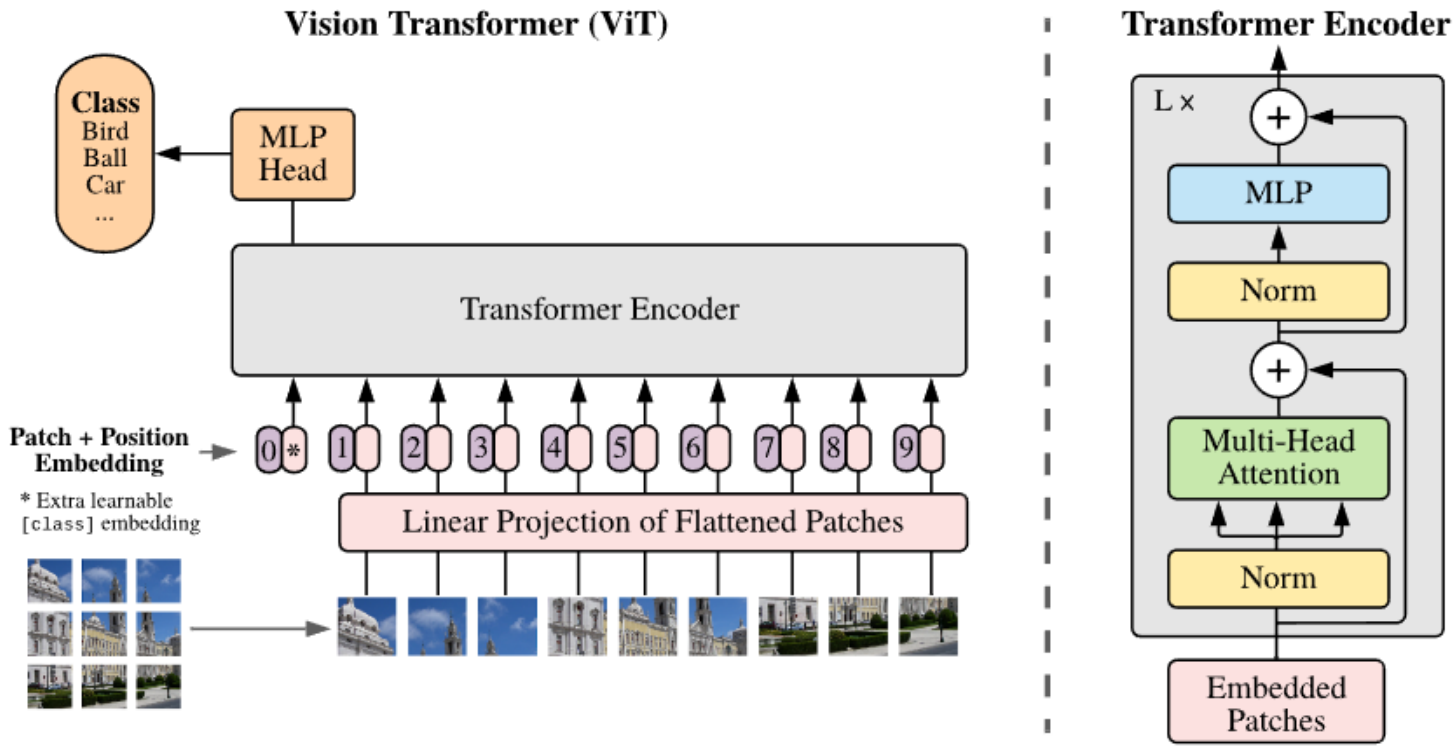


CrisisLex Twitter dataset



Swedish tweets w. Google translate

Image classification – ViT

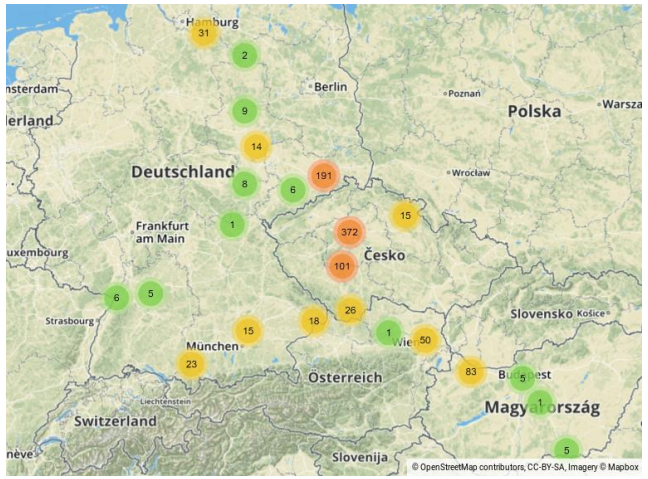


Dosovitskiy, Alexey. "An image is worth 16x16 words: Transformers for image recognition at scale." (2020).

Image classification – Fine-tuning data

EU Flooded 2013 Dataset

This dataset comprises images of major flood events in central Europe



https://inf-cv.uni-jena.de/home/research/datasets/eu-flood-dataset/

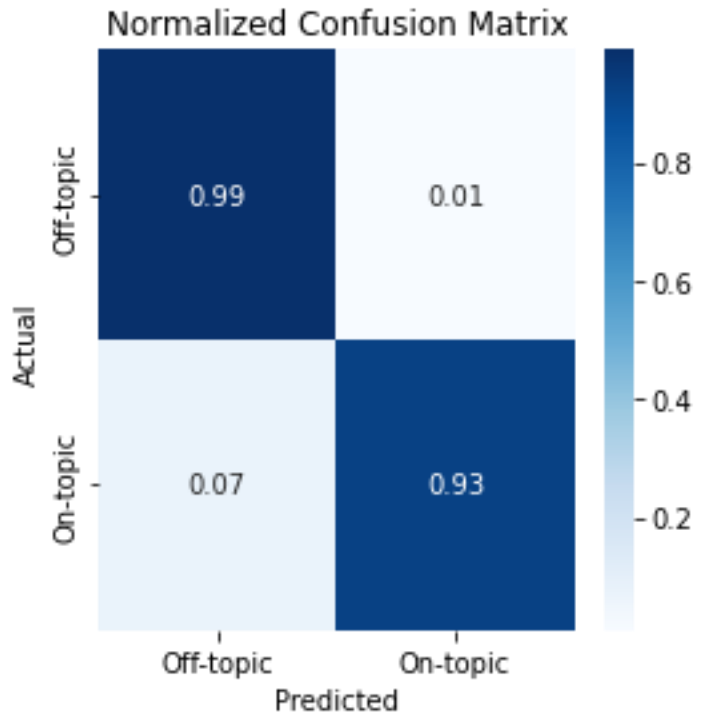
Image classification – Fine-tuned data

PASCAL VOC dataset - Visual Object Classes

http://host.robots.ox.ac.uk/pascal/VOC/voc2012/index.html

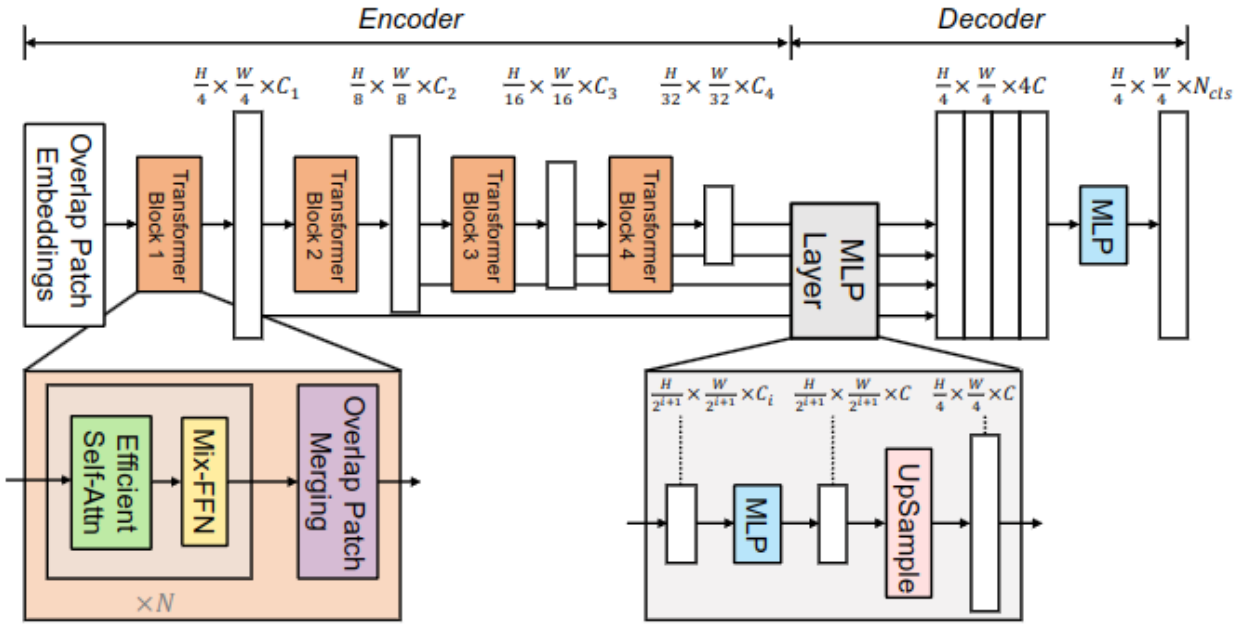
Image classification

- Vision Transformer (ViT)
- Fine-tuned with:
  - EU Flooded 2013 Dataset for on-topic images
  - PASCAL VOC dataset for off-topic images



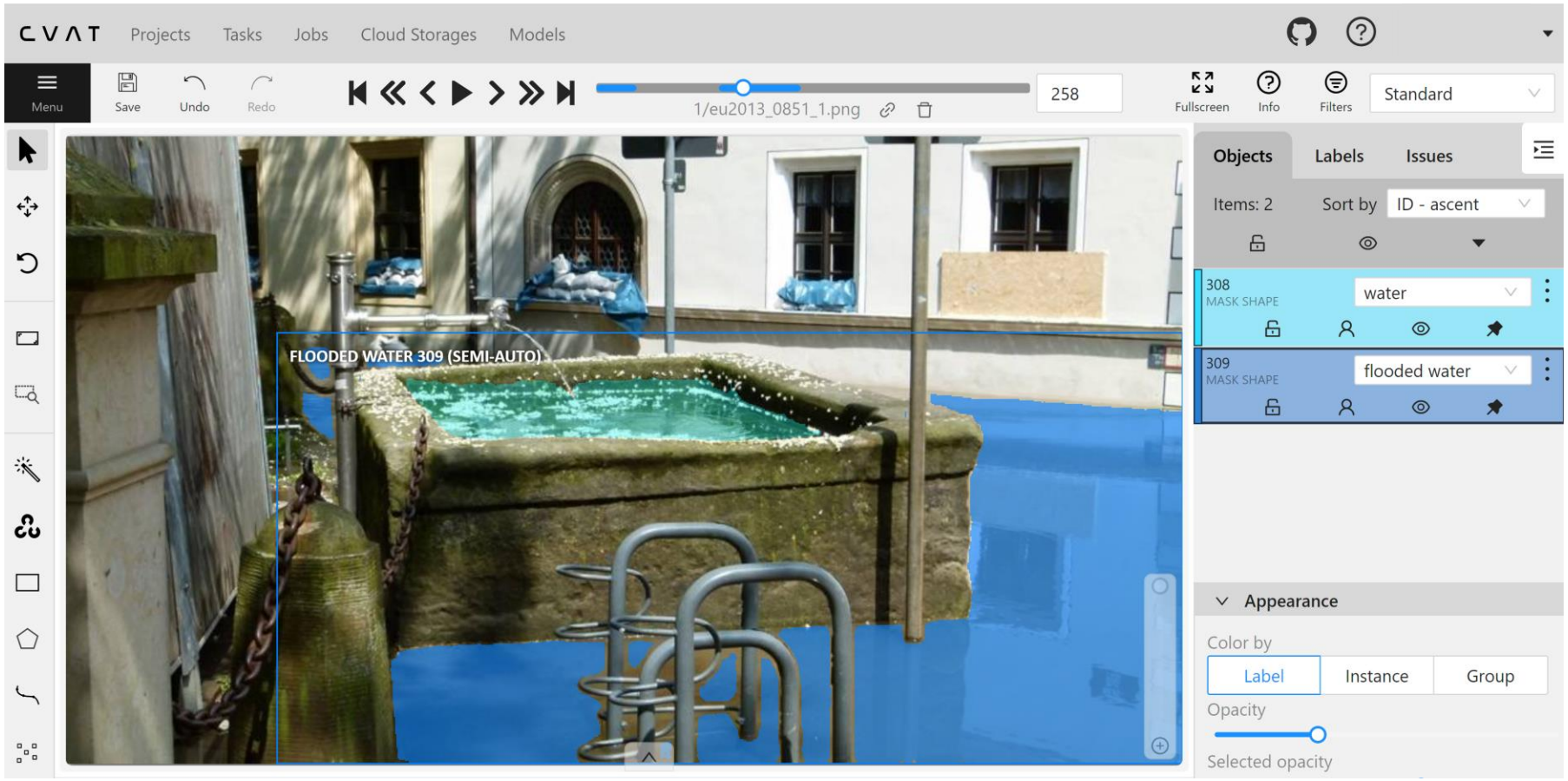
Semantic segmentation – SegFormer

https://commons.wikimedia.org/wiki/File:Image_segmentation.png



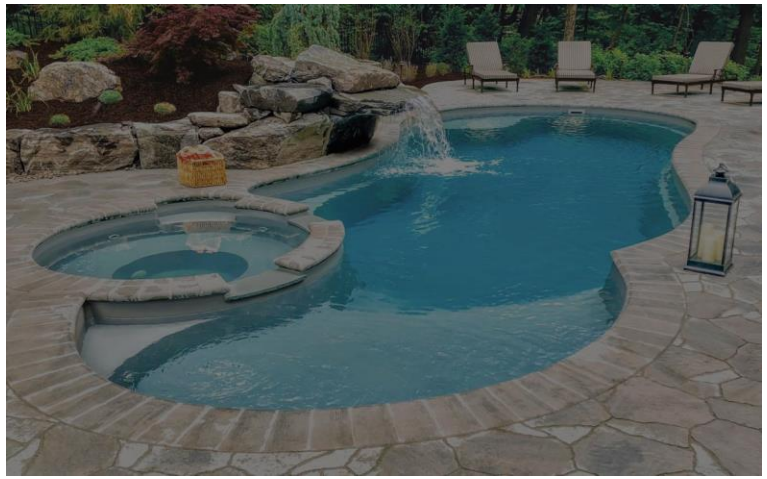
Xie, Enze, et al. "SegFormer: Simple and efficient design for semantic segmentation with transformers." (2021)

Semantic segmentation – Fine-tuned data

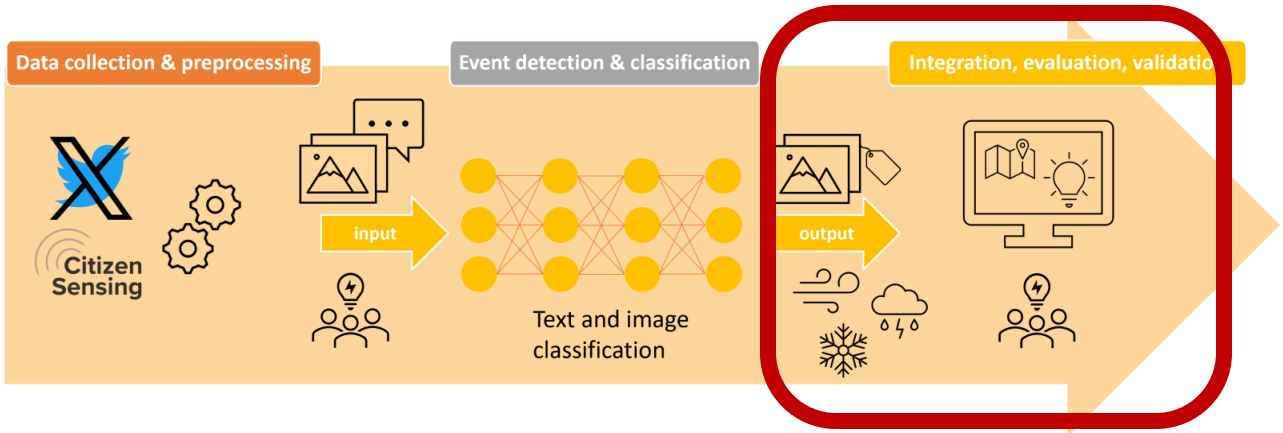


EU Flooded 2013 Dataset
Semi- automatic labeled with CVAT / SAM

Semantic segmentation - results



AI4CA visual interface



Map view

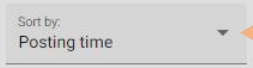
Reset map view

Image cloud view

Word cloud view

Posts view

Sorting options

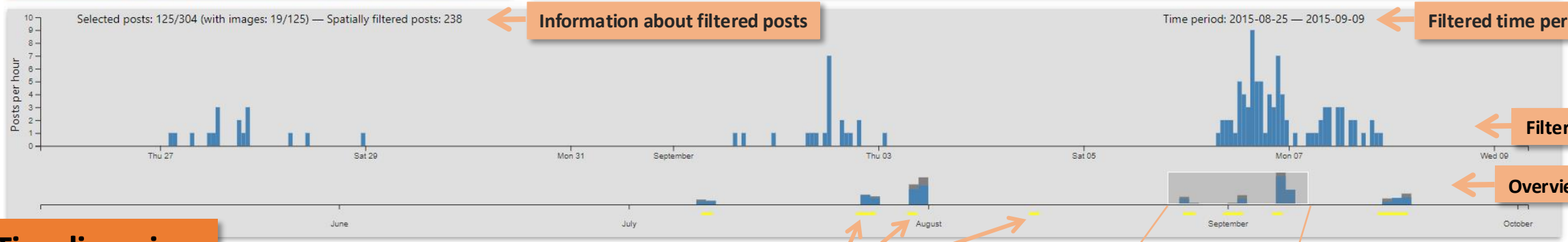


Classfication feedback

Timeline view

Information about filtered posts

Filtered time period

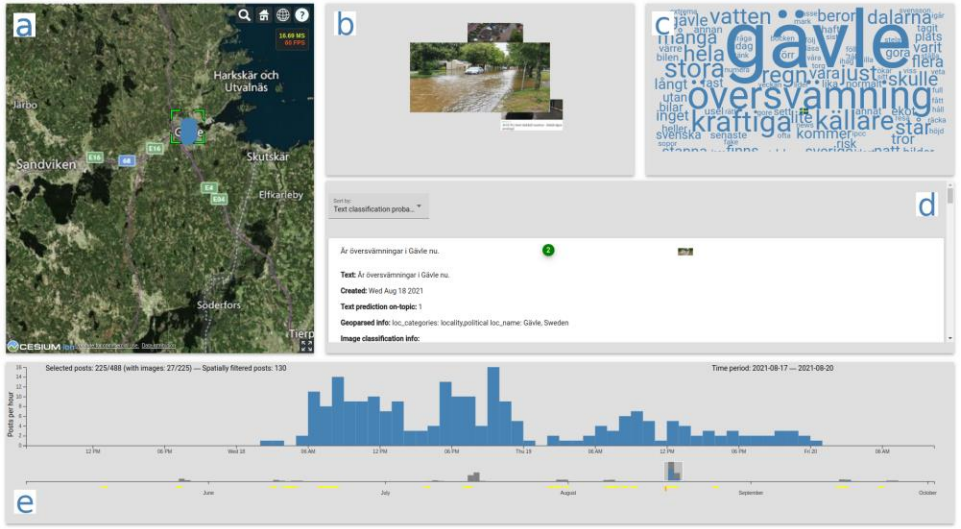


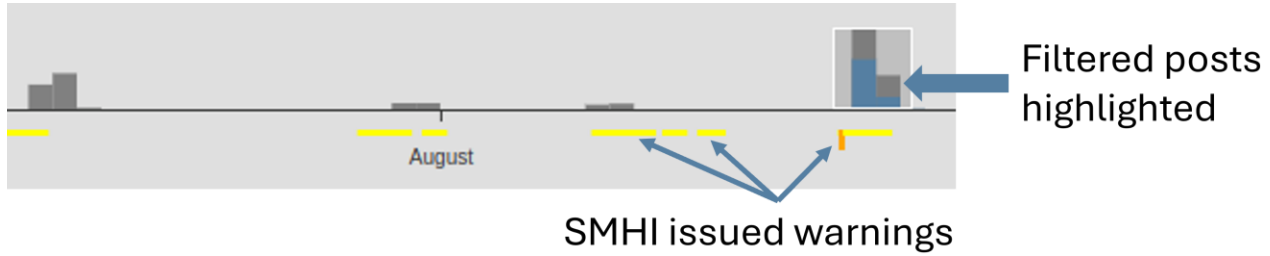
Filtered timeline

Overview timeline

SMHI warnings

Time window filter


a
Harkskär och Utvalnäs
Sandviken
Skutskär
Söderfors
b
c
gävle
vatten
dalarna
oversvämning
kraftiga
källare
stora
hela
regn
skulle
d
Är översvämningar i Gävle nu.
Text: Är översvämningar i Gävle nu.
Created: Wed Aug 18 2021
Text prediction on-topic: 1
Geoparsed info: loc_categories: locality,political loc_name: Gävle, Sweden
Image classification info:
e
Selected posts: 225/488 (with images: 27/225) — Spatially filtered posts: 130
Time period: 2021-08-17 — 2021-08-20
Posts per hour


August
Filtered posts highlighted
SMHI issued warnings

AI4CA interface – user tests

User tests September 2023 — 14 SMHI experts: meteorologists, hydrologists

Guided & unguided tasks

Screen & voice capture

System Usability Survey

Coded interaction sequences → patterns of use

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