UNECE ML Group 2022 Webinar

Applications of Machine Learning III: Imagery data

Joep Burger, Statistics Netherlands, j.burger@cbs.nl
30th November 2022

Research Group

– Targeted at members who already have strong experience of working with EO and ML

– Joep Burger (CBS), Alison Bailey (ONS), Gillian Milani (BFS), Tom Seimandi (INSEE), Clement Guillo (INSEE), Julien Jamme (INSEE), Ferda Ofli (HBKU), Ingmar Weber (HBKU), Fabrizio De Fausti (ISTAT), Teo Nguyen (UPPA), Jacinta Holloway (University of Adelaide), Arie Wahyu Wijayanto (Statistics Indonesia), Aiden Price (QUT), Kerrie Mengersen (QUT)

Overview

– Research questions, (open) data, methods
– Reading and discussing
  • CNN architectures
  • Class imbalance
  • Explainable AI

CNN architectures

–   Zhu et al. (2017) Deep learning in remote sensing, *IEEE Geoscience and Remote Sensing Magazine*, https://doi.org//10.1109/MGRS.2017.2762307

–   Spectral vs. radar/lidar

–   Multispectral vs. hyperspectral

–   CNN de facto standard

- outperform traditional computer vision methods
- learn features automatically

–   ResNet good starting point

–   Future: Vision Transformers?

Class imbalance

– Johnson and Khoshgoftaar (2019) Survey on deep learning with class imbalance, *Journal of Big Data*, https://doi.org/10.1186/s40537-019-0192-5

– Ratio between most and least abundant class [1, Inf)

– Data-level methods

  • under-/ oversampling, two-phase learning, dynamic sampling

– Algorithmic level methods

  • adjusted loss function, cost-sensitive learning, output thresholding

– Hybrid methods

Explainable AI

–   Gevaert (2022) Explainable AI for earth observation: A review including societal and regulatory perspectives, *International Journal of Applied Earth Observations and Geoinformation*, https://doi.org/10.1016/j.jag.2022.102869

–   Intrinsic vs. post-hoc

–   Model-specific vs. model-agnostic

–   Global vs. local

–   Predictive accuracy vs. descriptive accuracy

–   Adjust explanation to user

–   Grad-CAM

Conclusion

– Personally learned a lot and enjoyed the meetings

– Manage expectations

– How to preserve initial curiosity and enthusiasm?

EO Study group update 30 November 2022

- Study group format
  - Mix of experience and skills
  - Beginner to intermediate
  - ARSET online training
  - Regular meetings
- ARSET online training – recorded webinars, pdfs of presentations, transcripts of Q&A sessions
- Beginners
  - [ARSET - Fundamentals of Remote Sensing](#)
- Intermediate
  - [ARSET - Using Google Earth Engine for Land Monitoring Applications](#)
- Other courses
  - [ARSET - Evaluating Ecosystem Services with Remote Sensing](#)
  - [ARSET - Remote Sensing of Coastal Ecosystems](#)
  - [ARSET – Land Cover Classification with Satellite Imagery](#)
- Feedback
  - Very positive
  - Motivating to have shared goals and mutually agreed deadlines
  - Invaluable to meet and discuss issues
  - Recommended format for self-capacity building group