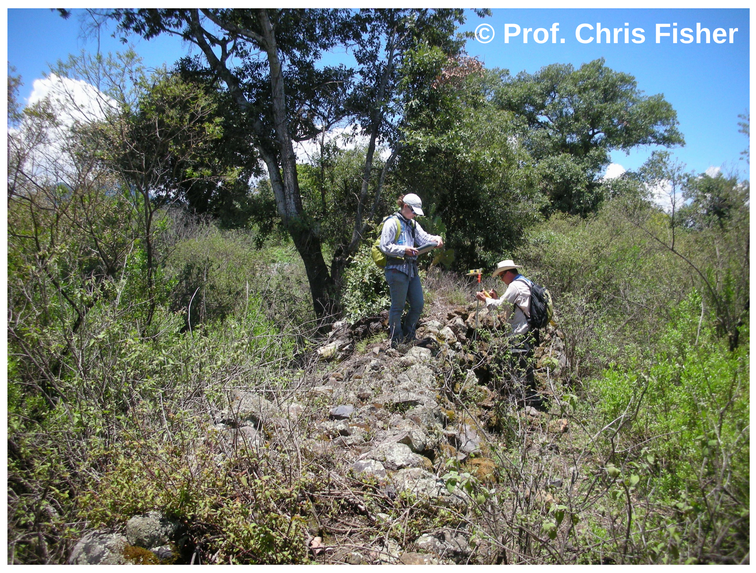
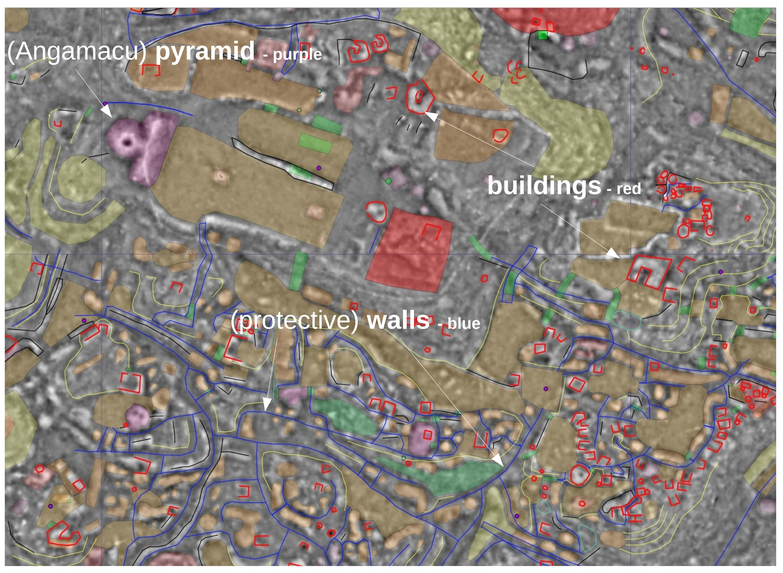
HELMHOLTZ AI | ARTIFICIAL INTELLIGENCE COOPERATION UNIT

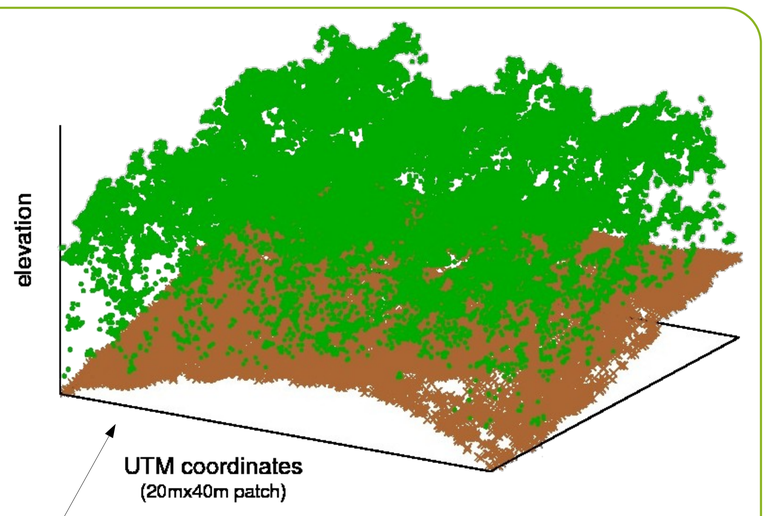
AI4Archeology:
On Global Hunt for Ancient Treasures with Machine Learning

Conrad M Albrecht & YIG team DM4EO@DLR (Germany) in collaboration with
Colorado State University (USA), Ben Gurion University (Israel), Yamagata University (Japan), and IBM Research

I. Angamacu, Mexico: Virtually Ranging the Woods for Ancient Cities







Albrecht et al., *Learning and Recognizing Archeological Features from LiDAR Data* (IEEE BigData 2019)

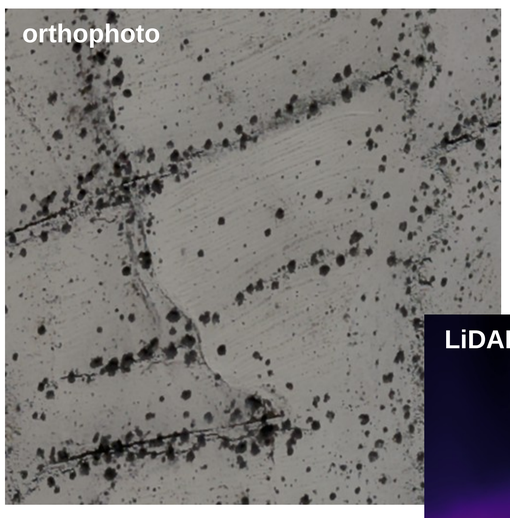
Colorado State University

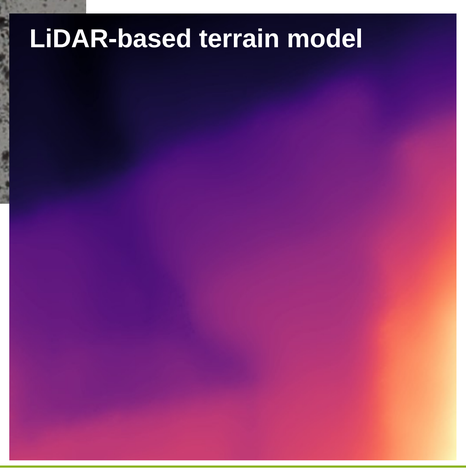
II. Negev agriculture, Israel: Uncover Ancient Terraces in the Desert

https://twitter.com/hidadigital/status/1519609049238712320?s=21

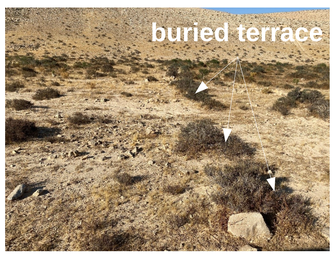
winning the 2022 HIDA *International AI Archeology Challenge*, facts:

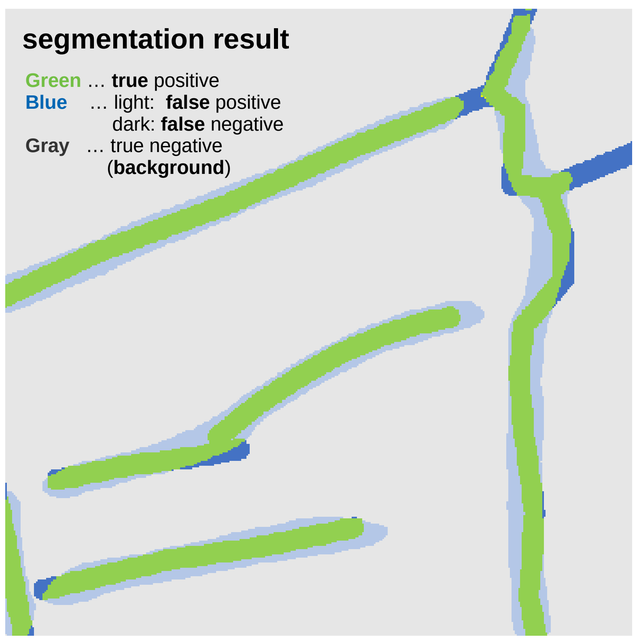
- **host** (© on illustrations & raw data): Ben Gurion University of the Negev, Prof. em. Paul Feigin
- **time frame**: 2 days
- **participants**: 9 student teams from Israel, Germany, Poland, India & Mexico
- **objective**: identify ancient agriculture terraces and walls in Negev desert
- **computer vision task**: multi-class semantic segmentation evaluated on Intersection-over-Union (IoU)
- **data** source: orthophotos + LiDAR feature maps (elevation, slope, etc.)
- scarce data **volume**: 500 training patches, 200 testing patches
- **winning solution**: fusing models *EfficientNet & DeepLab3+* with *EfficientNet & U-Net* outperformes competitors by large relative margin, IoU=.31 (others: .07 to .18)





Archeological Artifacts (ground truth photos)





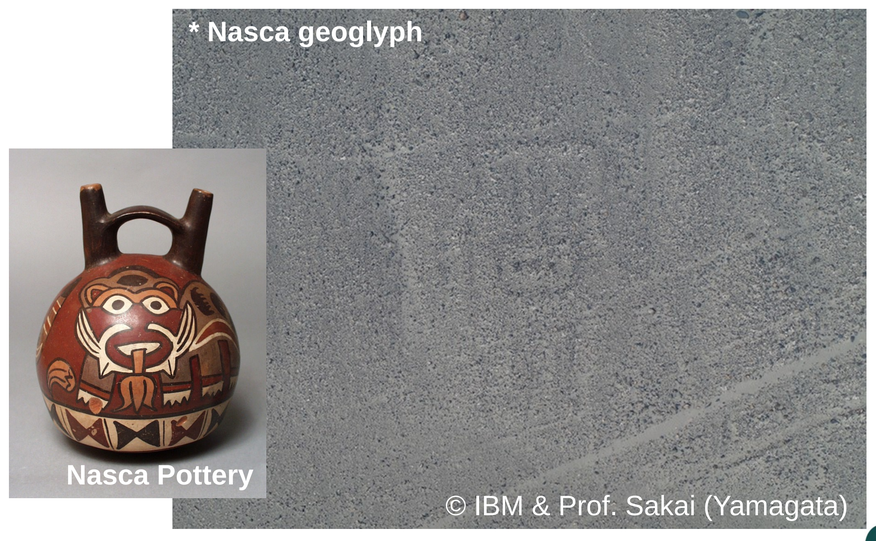
HiDA

III. Nasca culture, Peru: Spotting Geoglyphs with the Eye of an Eagle

1. **Geoglyphs distribution**
   In 2019 IBM Japan with Prof. Masato Sakai (Yamagata University) identified a new geoglyph*. Now, a large-scale, joint project is underway to automatically scan the entire Nasca Pampa with the aid of AI.

2. **Nasca pottery classification**
   Automatize identification of historical periods of pottery fragments by state-of-the-art computer vision models.

STAY TUNED FOR EXCITING FINDINGS 2B PUBLISHED!



https://www.ibm.com/blogs/research/2019/11/nasca-lines-geoglyphs

山形大学 YAMAGATA UNIVERSITY IBM

Perspectives: Cont'd Nasca & LiDAR Carthography of Amazon

- continue collaboration in **Nasca culture analytics with the aid of AI** (e.g., apply Negev analytics to Nasca path identification)
- utilize ***Alexander von Humboldt Foundation*** BRAGFOST22 and GAFOE23 CONNECT follow-up **funding** for German-Brazil-USA collaboration on **LiDAR scanning the Amazon** rainforest for new **ancient discoveries, biodiversity mapping, and development of sustainable agroforestry**

Alexander von Humboldt Stiftung/Foundation