CERN openlab

Satellite Image Analysis for UNOSAT

CERN openlab Technical Workshop

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Introduction

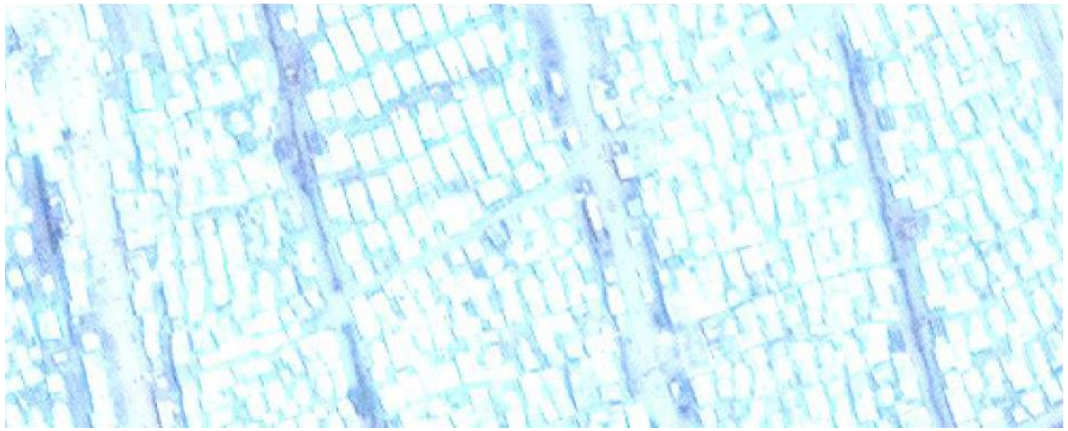
"The world has never recorded such a high amount of refugees in history"

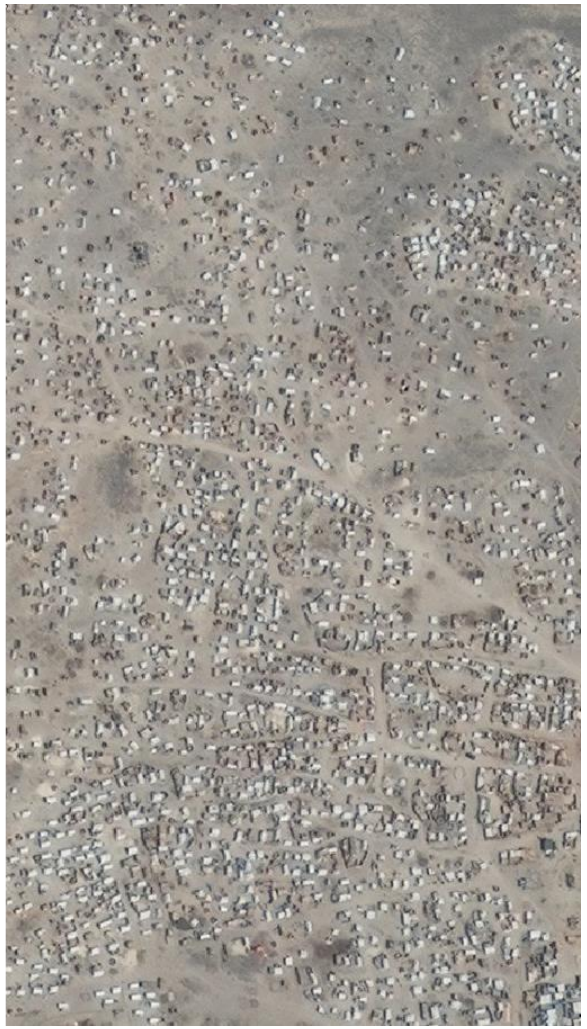
- 68.5 Million refugees across the globe
- Often located in remote and/or conflict zones
  - Chaotic and difficult to keep track of
- Satellite Imagery Analysis as a tool to fight the situation and provide aid
  - UNOSAT : a subdivision of UNITAR at CERN
  - Provide information on refugee camps

Current State

- UNOSAT consist of a team of highly trained analysts
- Experts analyze the imagery to provide information
- Time-costly operation and only 5% of requests are answered
  - The gathered information is needed to count tents/areas to determine the amount of aid
  - In conflict zones: Damage assessment, pre-mission information for rescue teams
- Shelter and Camp Variety increases difficulty

Camp Variety Challenge





Shelter Variety

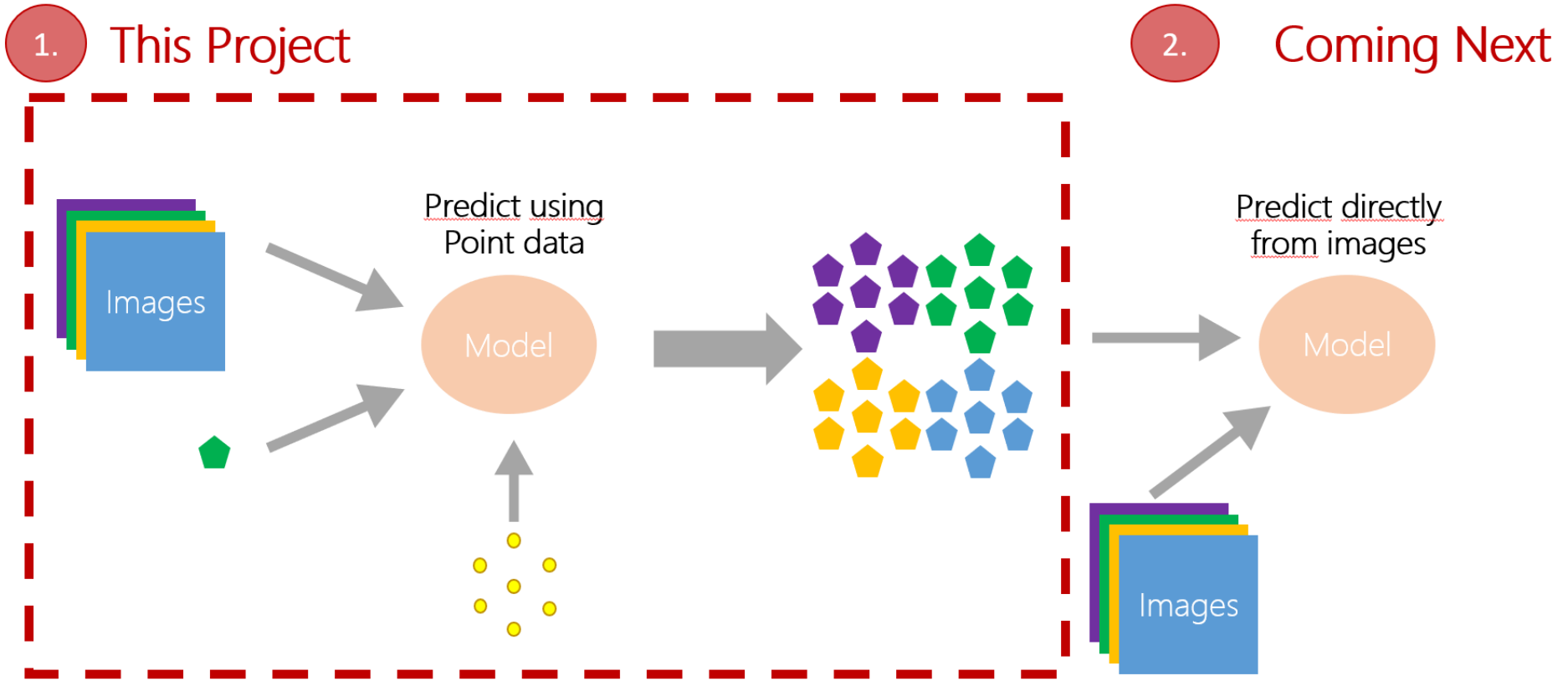
Challenges Tackled

Make more data usable

- UNOSAT generates point data
  - A single point representing the entire tent
  - Not representative enough
- Polygons representing more information
  - Only couple camps have been “polygonised”

Our Approach

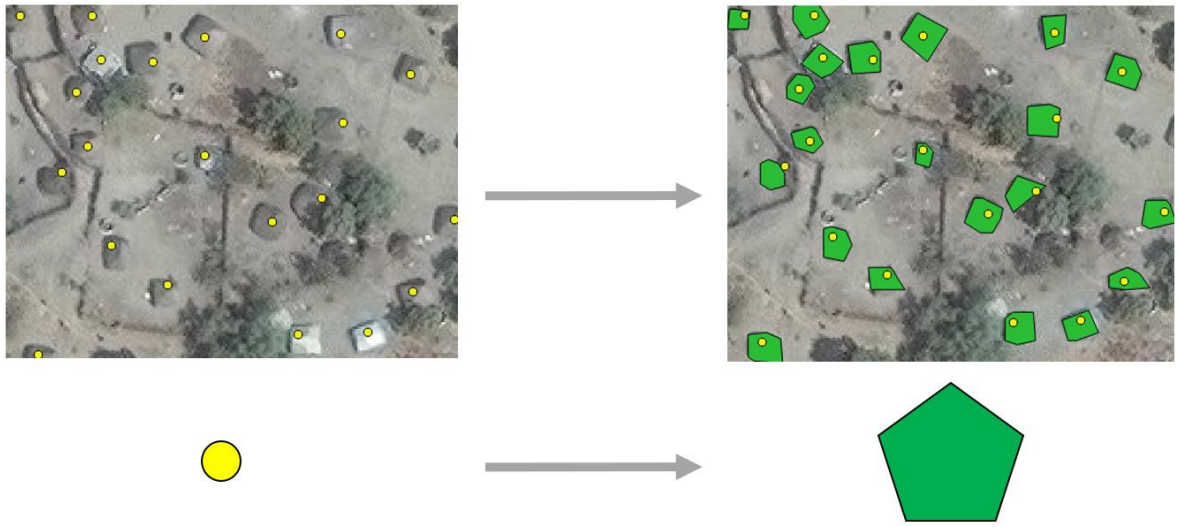
Two Steps model



Last Summer

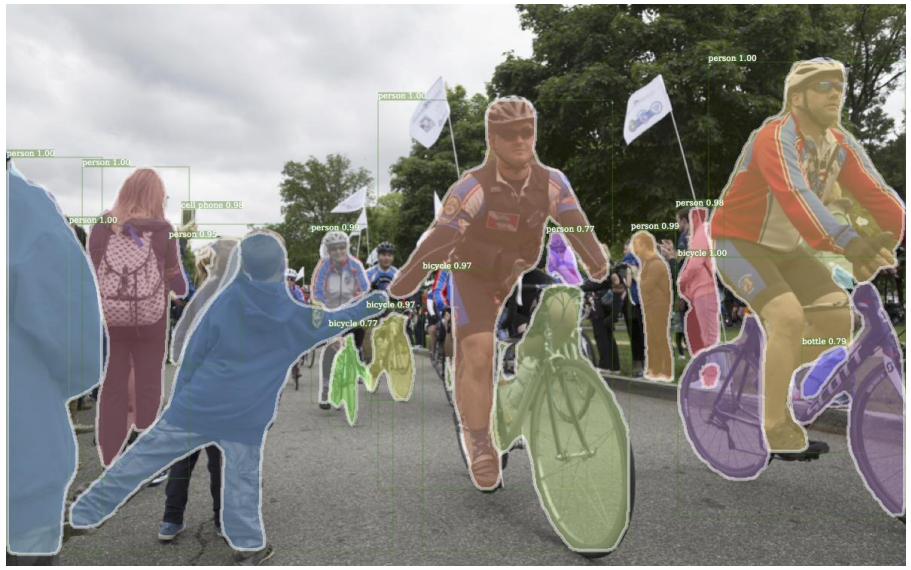
Work done together with Nathan Lacroix, Sofia Vallecorsa and UNOSAT

- Translation of point data generated by UNOSAT Analyst to entire tents
- Why?
  - Machine Learning techniques require full tent for training



Method

Transfer Learning from pretrained object detector model (RCNN)



Detectron Framework (FacebookAI)

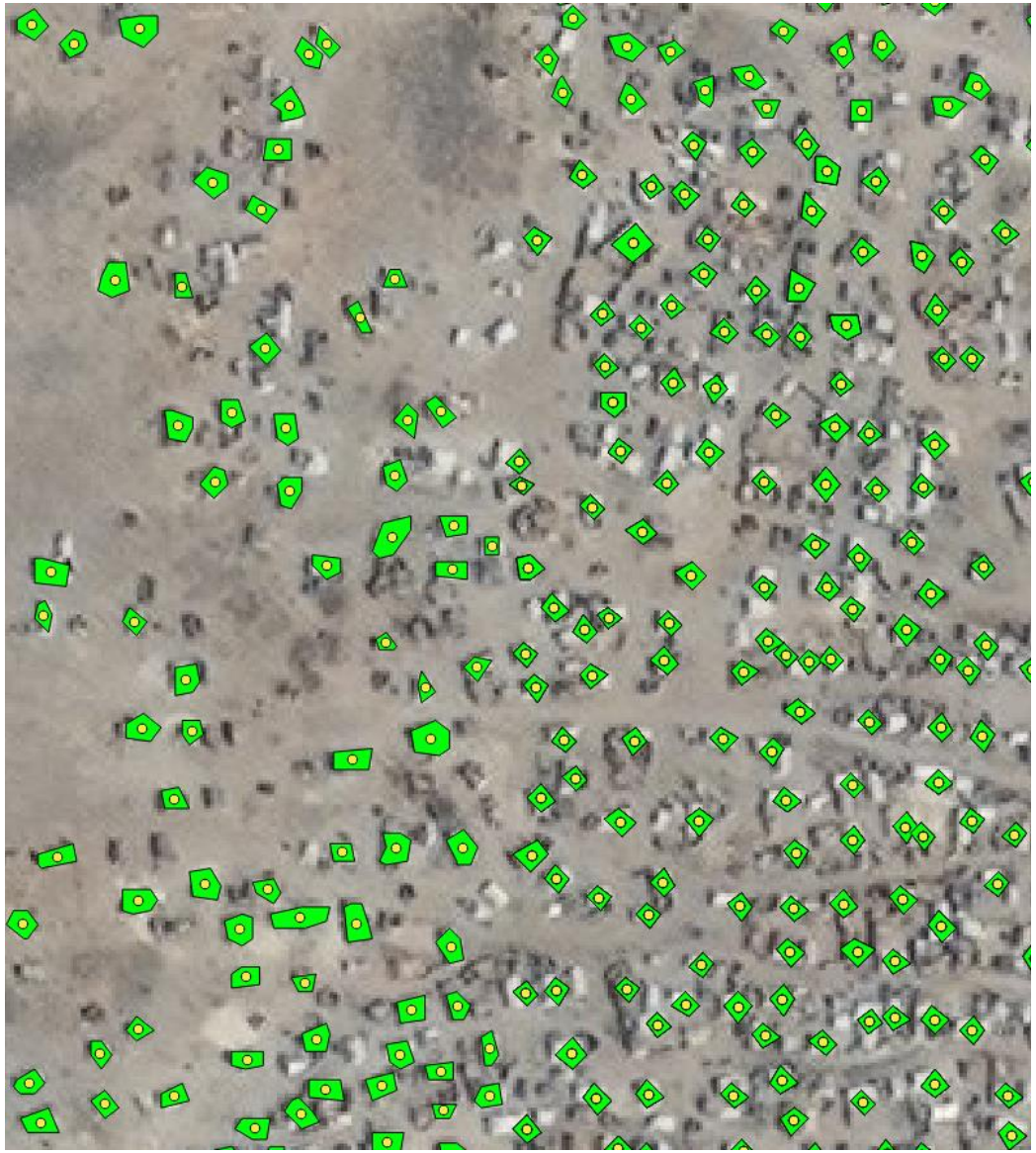
Retrain &
encode point data
cleverly

Unosat Adapted model

Results

Point Data

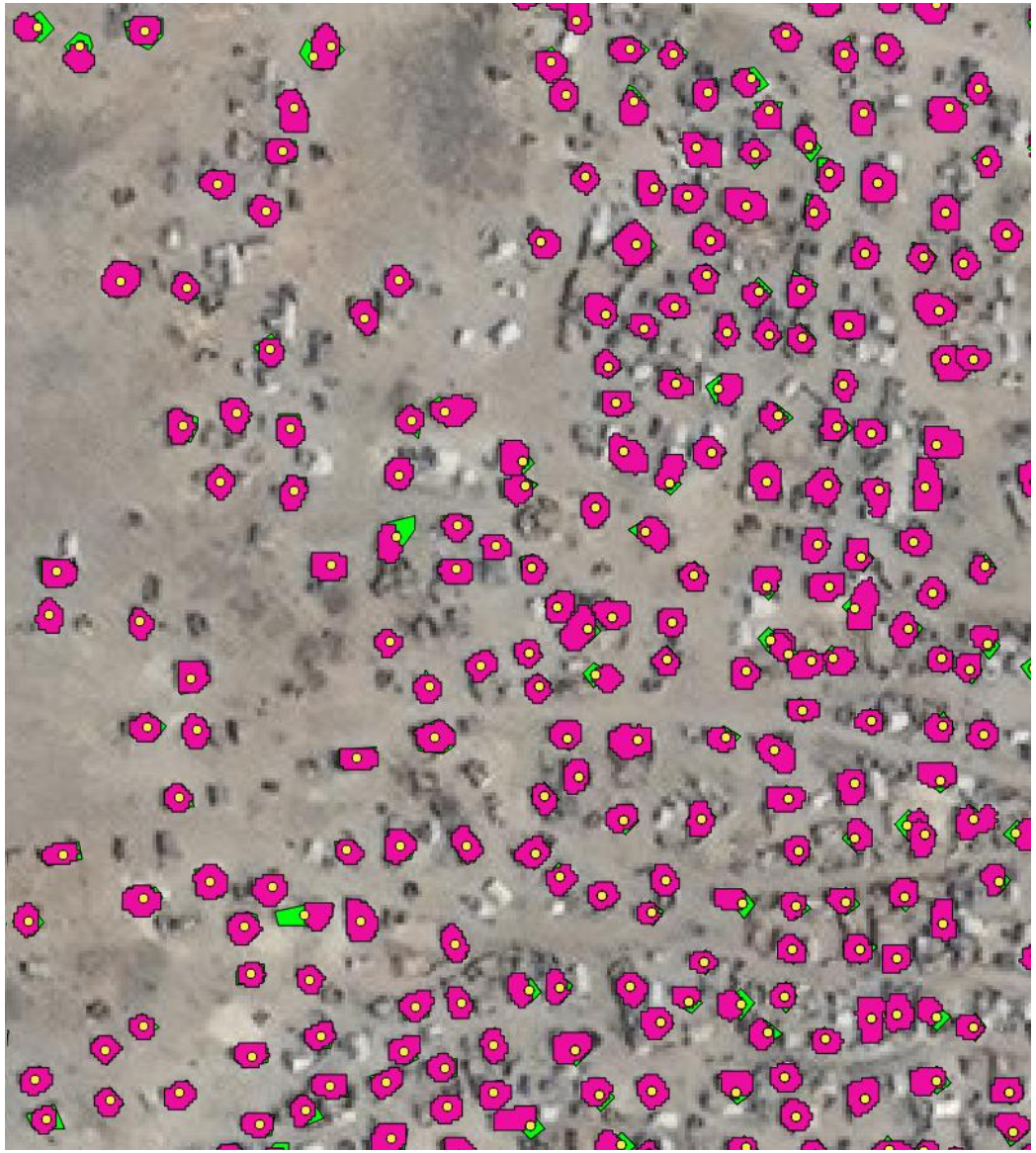
Results



Point Data

Human Ground Truth

Results

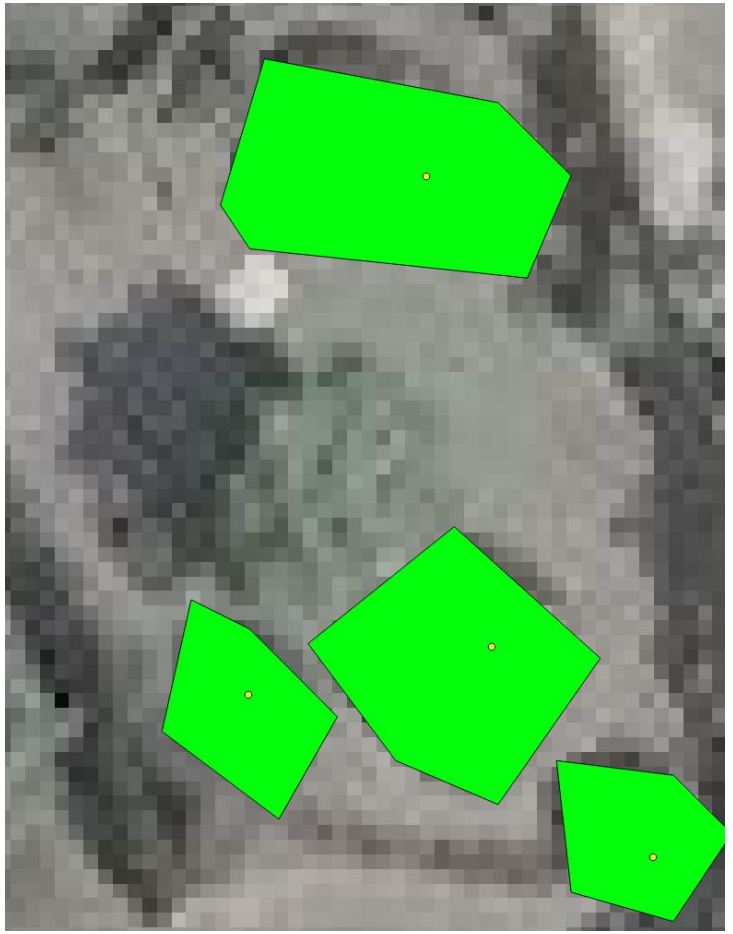


Point Data

Human Ground Truth

Neural Network Prediction

Results



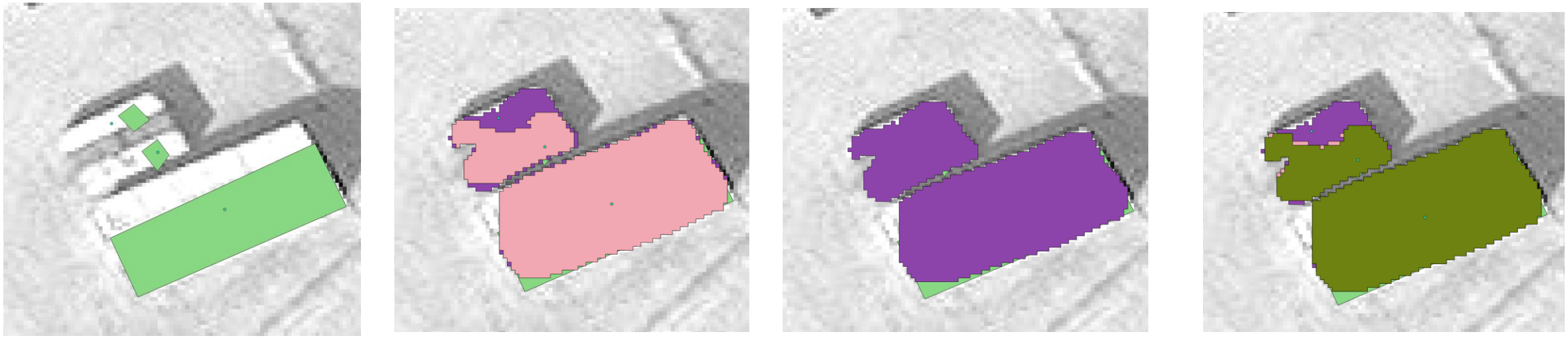
Point Data

Human Ground Truth

Neural Network Prediction

Some more camps

Man made truth – network2epoch – network3epoch – network4epoch



Some more camps

Camp – Man-made – Network predicted

Results

- Inference time is significantly reduced
- Augmented Data Set
- Upcoming Project:
  - Application of GANs for generation of refugee camp images

Generative Adversarial Networks

Generating High Resolution Satellite Imagery

- Satellites are expensive
  - Obtaining images takes time
  - Is expensive
  - License issue when sharing across institutes

- Synthetic high resolution images
  - No sharing issues
  - Can be used for training predictive models
  - Is not expensive

Generative Adversarial Networks

Initial Results

- Promising initial results
- Limitation:
  - Size of tiles
  - Next challenge: Full Tent

Conclusion

- Summer Project on point → polygon is being used by UNOSAT
  - Valuable tool for upgrading the existing predictive tools

- Next challenge to solve:
  - Generating High Resolution Satellite Images
  - ATTRACT Proposal with Intel and UNOSAT