HIDA Hackathon

Feb 2024

Unstable Unicorns

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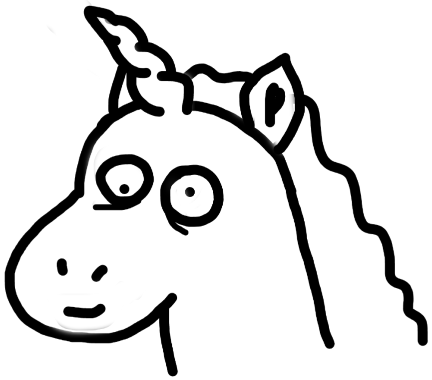

First things first - Google your task

Where is the dataset from? Was it analyzed before?

Thermal Bridges on Building Rooftops - Hyperspectral (RGB + Thermal + Height) drone images of Karlsruhe, Germany, with thermal bridge annotations

Mayer, Zoe; Hou, Yu; Kahn, James ; Beiersdörfer, Tobias; Volk, Rebekka

Abstract:

The dataset of Thermal Bridges on Building Rooftops (TBBR dataset) consists of annotated combined RGB and thermal drone images with a height map. The raw images for our dataset were recorded with a normal (RGB) and a FLIR-XT2 (thermal) camera on a DJI M600 drone. All images were recorded during a drone flight on March 19, 2019 from 7 a.m. to 8 a.m. At this time, temperatures were between 3.78 ° C and 4.97 ° C, humidity between 80% and 98%. There was no rain on the day of the flight, but there was 2.3mm/m² 48 hours beforehand. For recording the thermographic images an emissivity of 1.0 was set. The global radiation during this period was between 38.59 W / m² and 120.86 W / m². No direct sunlight can be seen visually on any of the recordings. The dataset contains 917 images with a total of 6895 annotations of thermal bridges on rooftops. The annotations only include thermal bridges that are visually identifiable with the human eye. Because of the image overlap each thermal bridge is annotated on average about 20 times from different angles.

Deep learning approaches to building rooftop thermal bridge detection from aerial images

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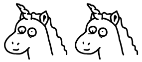
ABSTRACT

Thermal bridges are weak points of building envelopes that can lead to energy losses, collection of moisture, and formation of mould in the building fabric. To detect thermal bridges of large building stocks, drones with thermographic cameras can be used. As the manual analysis of comprehensive image datasets is very time-consuming, we investigate deep learning approaches for its automation. For this, we focus on thermal bridges on building rooftops recorded in panorama drone images from our updated dataset of Thermal Bridges on Building Rooftops (TBBRv2), containing 926 images with 6,927 annotations. The images include RGB, thermal, and height information. We compare state-of-the-art models with and without pretraining from five different neural network architectures: MaskRCNN R50, Swin-T transformer, TridentNet, FSAF, and a MaskRCNN R18 baseline. We find promising results, especially for pretrained models, scoring an Average Recall above 50 % for detecting large thermal bridges with a pretrained Swin-T Transformer model.

Overview

- **Data Exploration**
  - ➢ R, G, B, Thermal, Depth → Do we need all?
  - ➢ Unlabeled images ~200
- **Annotation issues**
  - ➢ Shifted Masks
- **Data Augmentation**
- **Baseline checks**
- **Other models**
  - ➢ UNet, SWIN-UNETR_v2, UNet with EfficientNet B1



Summary

UNet-EfficientNet B1 (pretrained) model with 3 input channels (grey-scale, thermal, depth)

Validation IoU: **~0.29**

Test IoU: **0.28273**

Main Takeaways:

- RGB channels mostly deteriorated performance → but grayscale is ok!
- Bounding boxes are annoying
- Smaller models for smaller datasets → MONAI works well!
- Manually look into your data

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