ZONING DETECTION BY SATELLITE IMAGES

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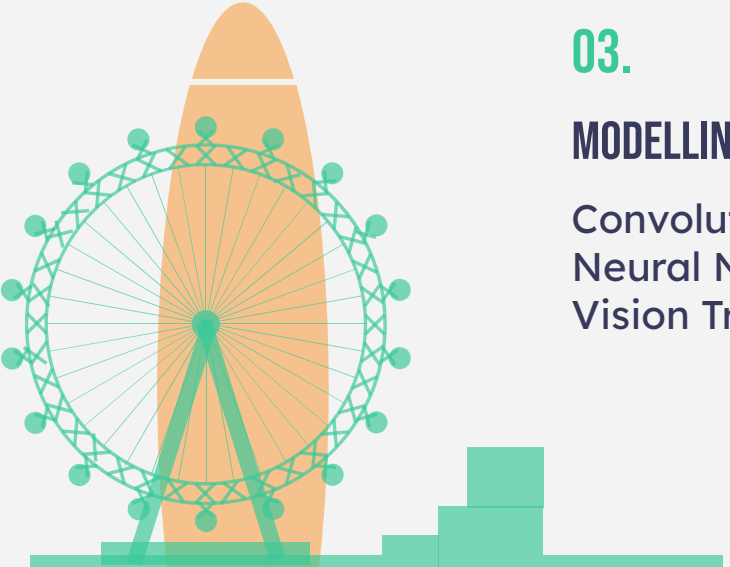

01.

PROBLEM STATEMENT

Use of ML/DL technology for zoning classification

02.

DATA & EDA

Distribution of labeled data, image exploration

03.

MODELLING

Convolutional Neural Networks, Vision Transformer

04.

INSIGHTS & CONCLUSION

Challenges, future works

01.

PROBLEM STATEMENT

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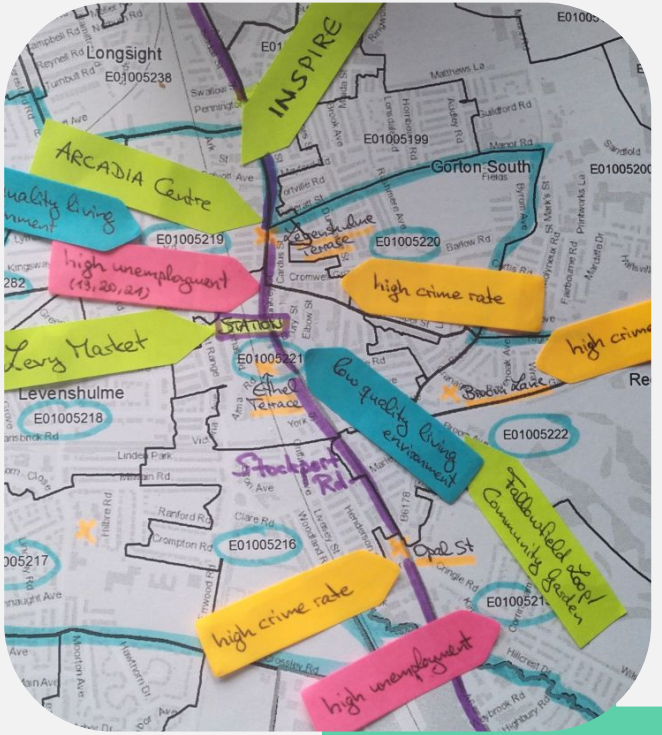
- Zoning is an important task for local governments, as they need to regulate which areas may have land used for particular purposes.
- For tasks such as urban planning, it is necessary to understand the structure and urban patterns of a city.
- Deep learning can help analyze and optimize agglomeration processes that occur in many large cities.

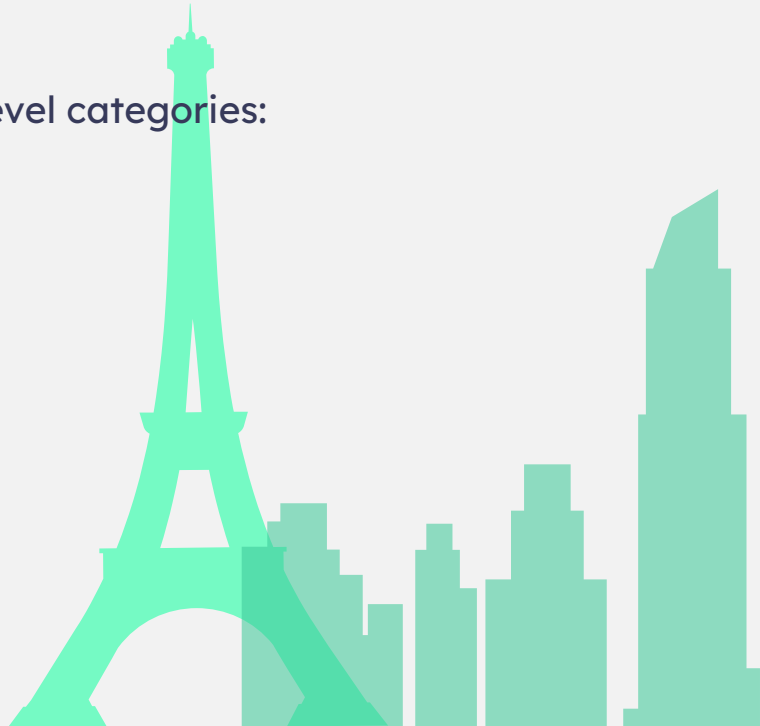


02.

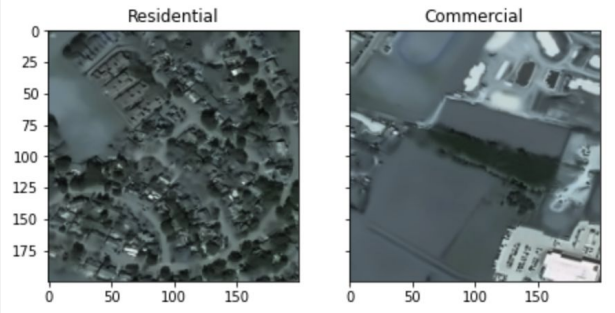
DATA & EXPLORATORY DATA ANALYSIS

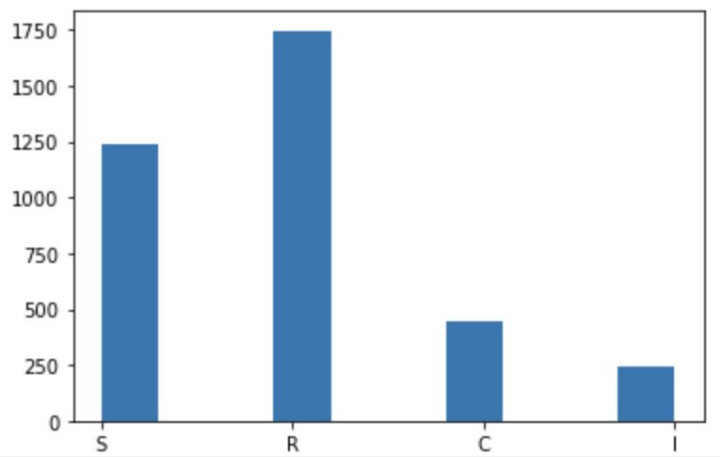
DATASET

- 3,666 labeled satellite images of Austin, Texas
- Images with dimensions (961, 773, 3)
- 167 unique zoning tags aggregated into 4 high-level categories:
  - Residential (R)
  - Commercial (C)
  - Industrial (I)
  - Special (S)



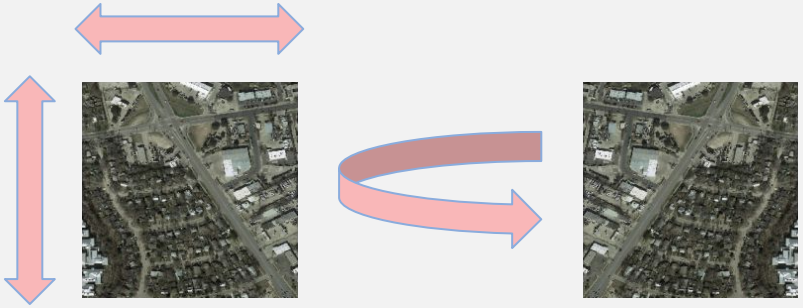
EXPLORATORY DATA ANALYSIS





FEATURE ENGINEERING

- Images resized to same dimensions
- Extract patches from images
- Data augmentation using different images transformations (rotations, flips, etc.)
- Bounding boxes

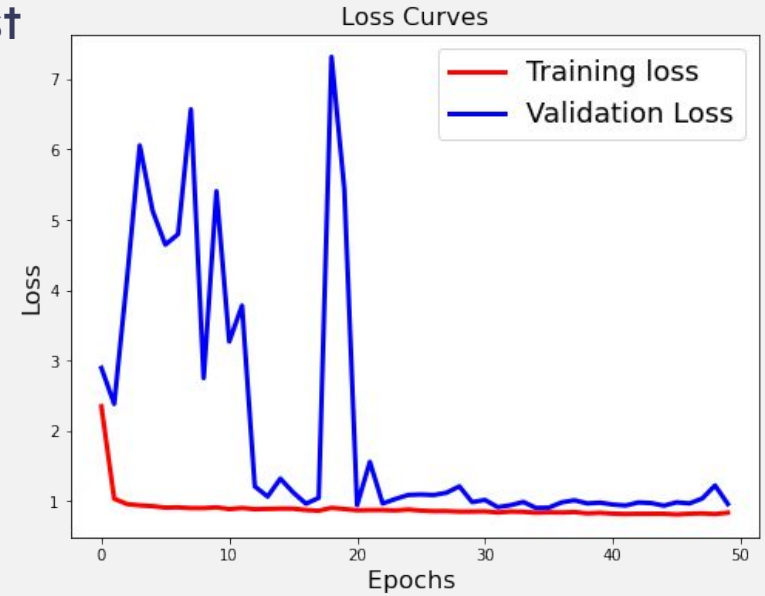


03.

MODELLING

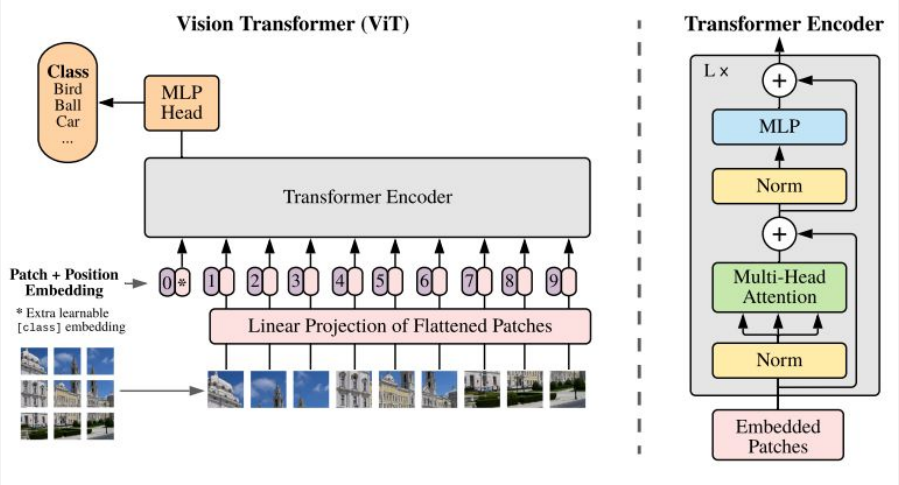
CNN STRUGGLED TO PERFORM IMAGE CLASSIFICATION

- Across all architectures, test accuracy never exceeded 62%
- Validation loss unstable
- Overfitting a common problem

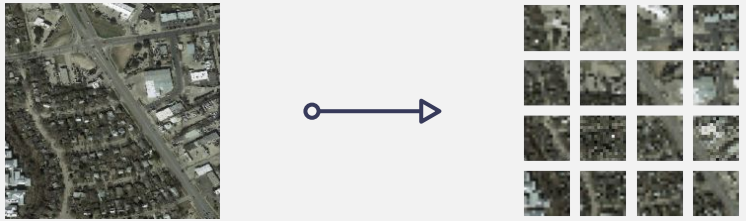


GOING BEYOND CNNS YIELDED LITTLE IMPROVEMENT

- Vision Transformer achieved high training accuracy, low test accuracy
- Transfer learning with image classification models only improved training accuracy



Dosovitskiy et al., 2010



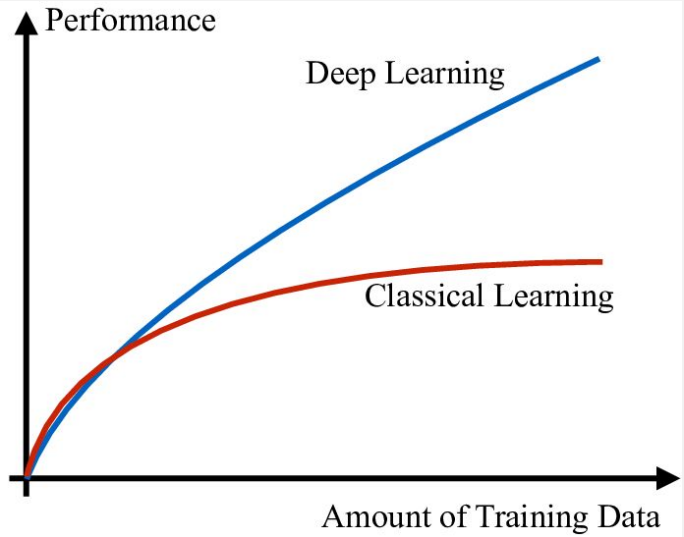
04.

INSIGHTS & CONCLUSIONS

ADDITIONAL LABELLED DATA IS THE KEY

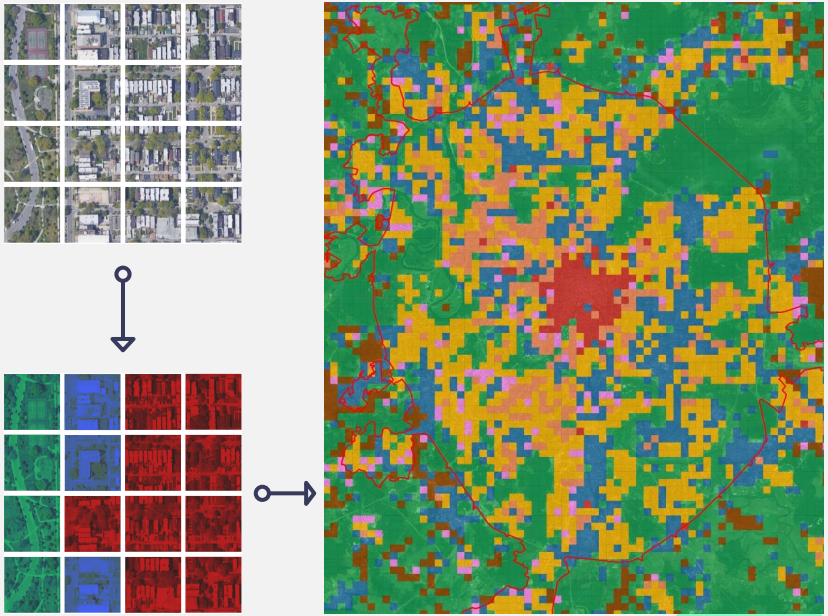
- Many of images in four classes look very similar; the images might need more classes that show the clear distinctions between classes

- 3666 images is not enough to train a network to distinguish these classes



POTENTIAL ML OPS - FUTURE WORKS

- With deploying the model into the mapping software like GIS and Google map module, visualization of zoning will be possible to show the overall zoning distribution of designated area
- The visualization will help for the urban planning for existing or new areas



THANKS!