

Land use classification tasks using CNN-based model: Multi-spatial scale Data Set

Rana Mahdavi, Thomas Maliappis | LIACS



Universiteit
Leiden
The Netherlands

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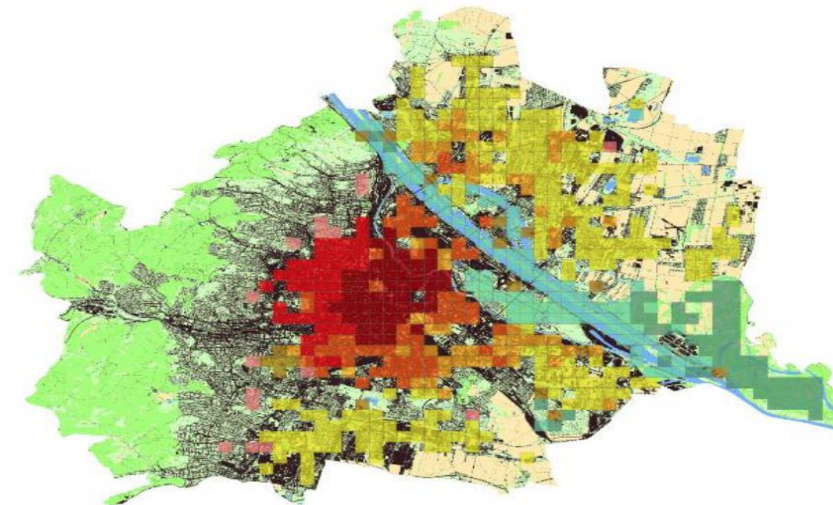
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Background

- **The Original Paper:** "Reading Cities with Computer Vision: a new multi-scale urban fabric data set"
- Understanding the typology of cities and their evolution is important
- Read and interpret urban fabric

Urban Fabric - Sub-type

- 2a - Late 19th century perimeter block development on sloping terrain (West Vienna)
- 2b - Late 19th century inner urban perimeter block development (Inner urban Vienna; Floridsdorf)
- 2c - Historic city centre
- 3a - Post WWII urban expansion areas (South/South East Vienna)
- 3b - Compact development in urban expansion areas and old village centres (North and East of Vienna)
- 3c - Single family houses (West Vienna)
- 6a - Riverine woodland (National Park 'Lobau')
- 6b - Waterside green spaces (east of the Danube)
- 6c - Waterside landscape parkland (Danube banks and Prater)



Background

Objective

- Ability to interpret, understand and classify diverse urban fabrics

Inputs

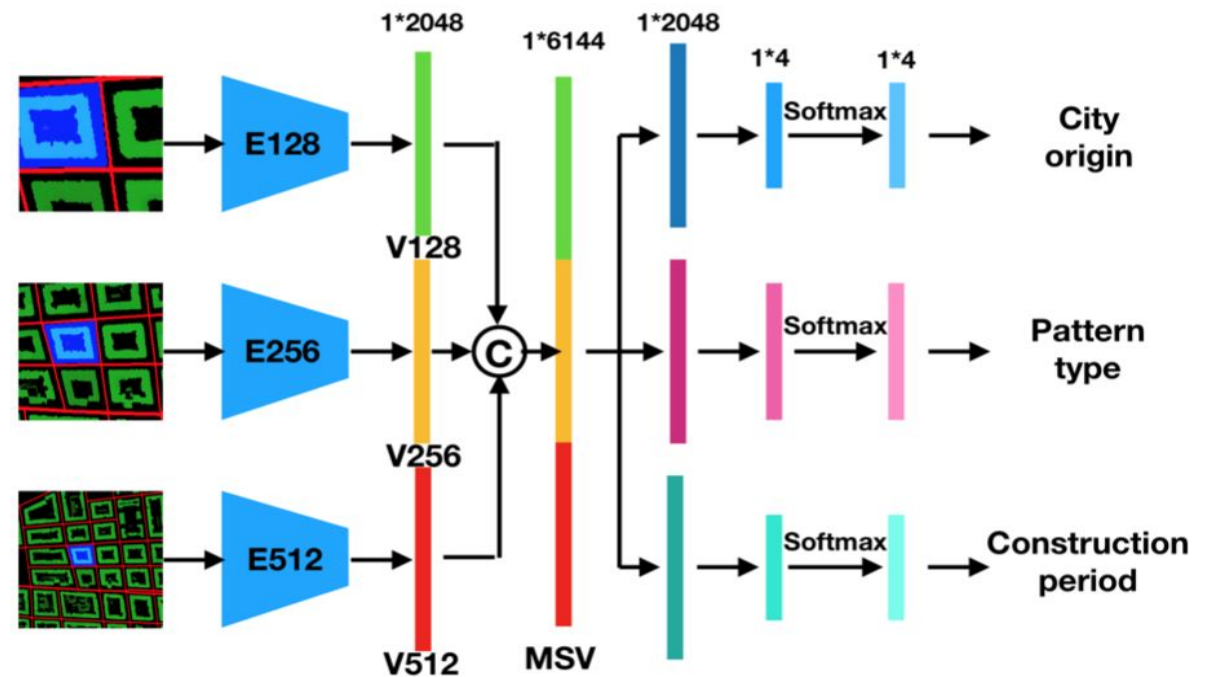
- Image-like data patches of varying spatial scales to pictorially represent each urban fabric
- 66k multi-spatial scale urban fabric samples extracted from four European cities

Classification of Urban fabrics in terms of :

- Prediction of urban fabric city origin
- Pattern Type
- Formation Period

Background

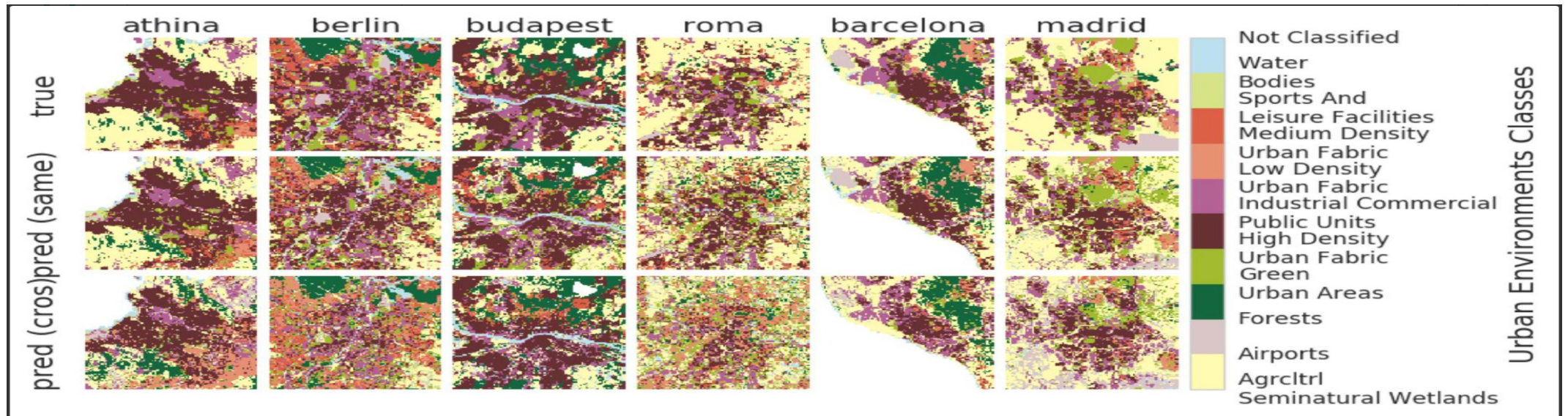
- Three different scale of inputs (128x128, 256x256, 512x512)
- Three different CNNs
- Feature Extraction
- Fuse the vectors
- Feed into three different classifier



New Idea

Using the introduced methodology for a new problem

- Classification Problem
 - Land use classification
 - City Classification



Problem statement

Land use classification

-Different applications

- Urban Planning
- Zoning and the issuing of business permits
- Real-estate construction
- Evaluation of infrastructure



Urban Atlas Dataset

- Land cover and land use data
- EEA38 countries, Turkey and United Kingdom
- 18 land classes

Google Statics API used to get satellite images

-- examples --

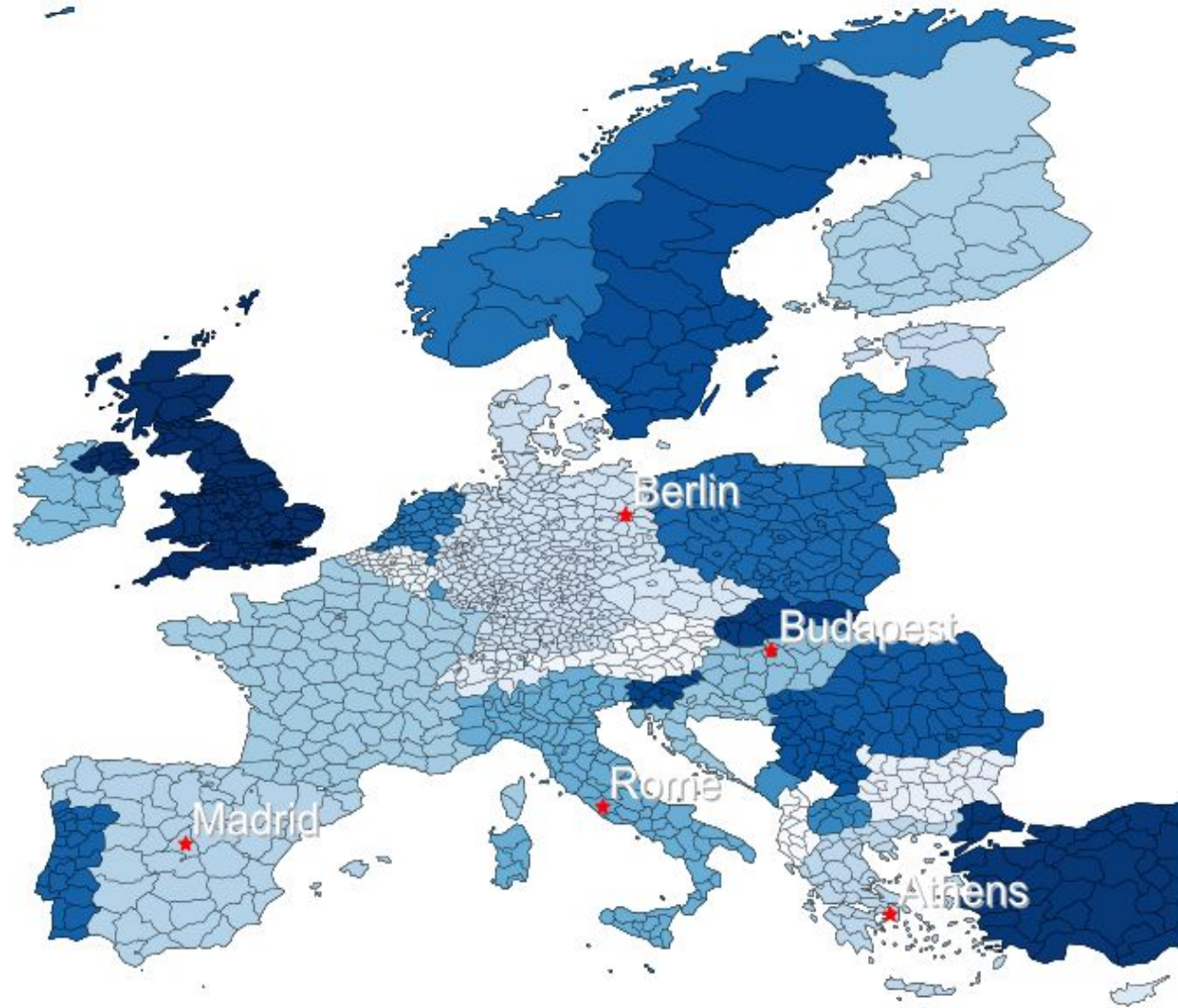


Agricultural
Seminatural Wetlands
Airports
Construction sites
Continuous Urban Fabric 80%
Discontinuous Dense Urban 80%
Discontinuous Low Density 30%
Discontinuous Medium Density 50%
Discontinuous Very Low 10%
Fast transit roads land
Forests
Green urban areas
Industrial commercial public units
Mineral extraction and sites
Other roads and land
Port areas
Railways and associated land
Sports and leisure facilities
Water bodies

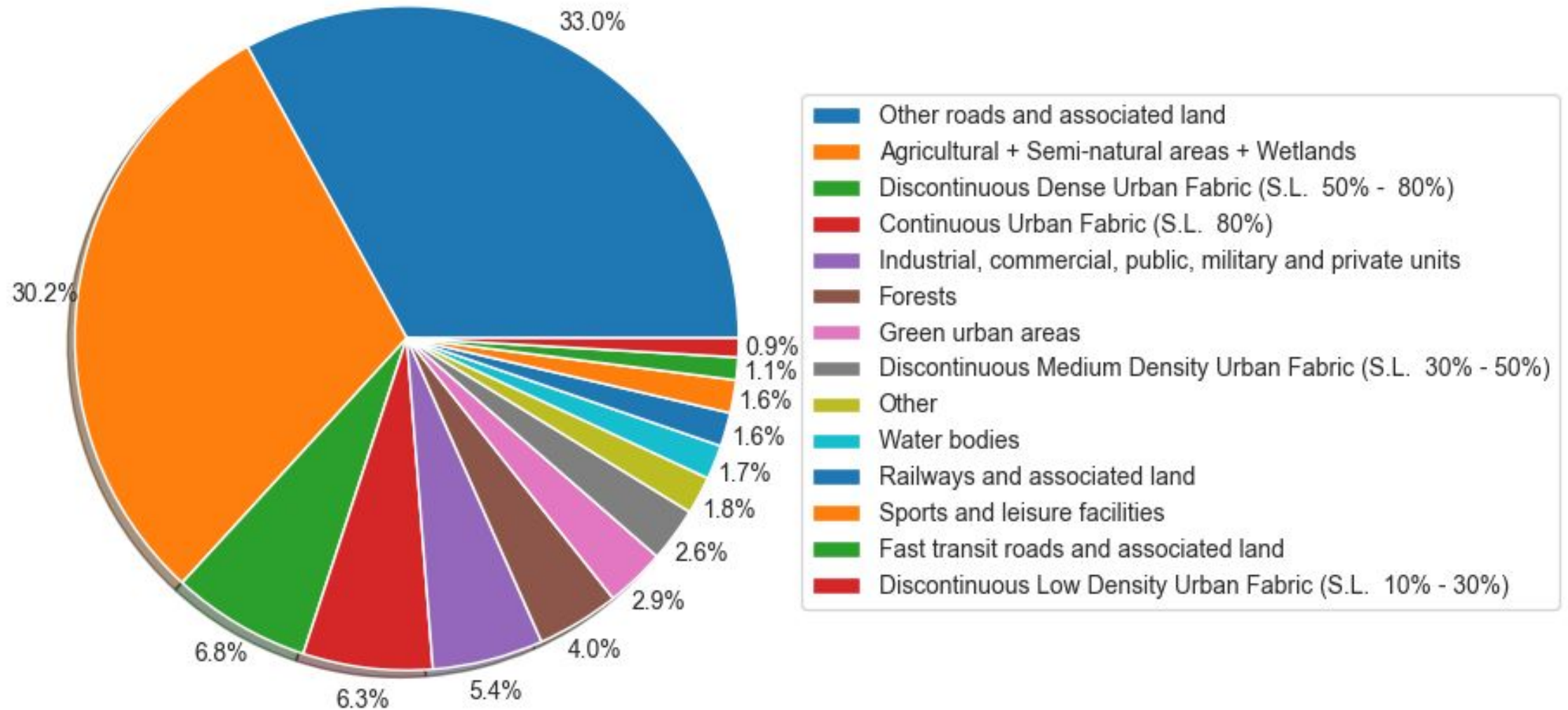
-- land classes --

Selected Cities

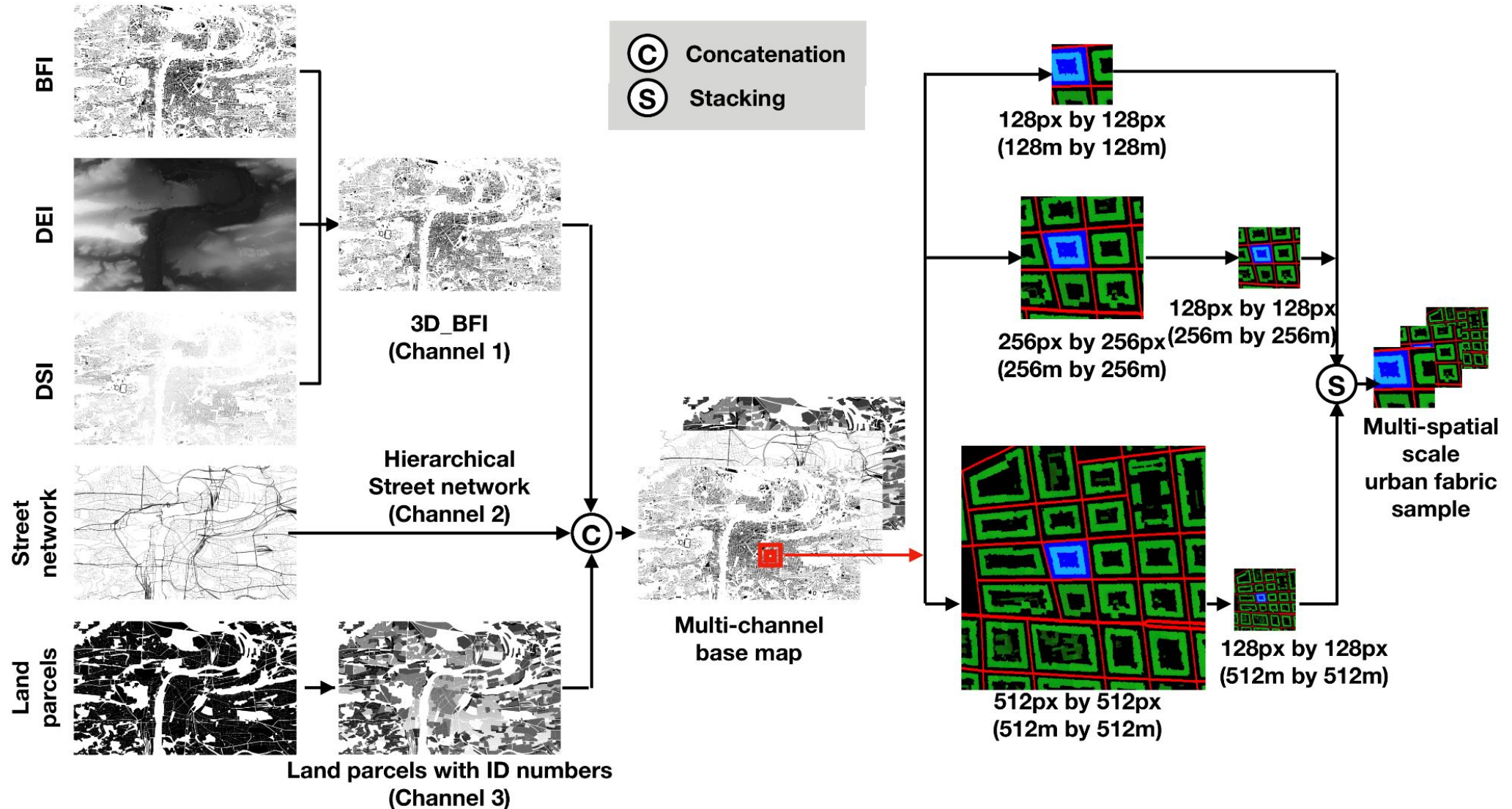
- Athens
 - 5022 samples
- Berlin
 - 5466 samples
- Budapest
 - 4658 samples
- Madrid
 - 7840 samples
- Rome
 - 5209 samples



Class distribution

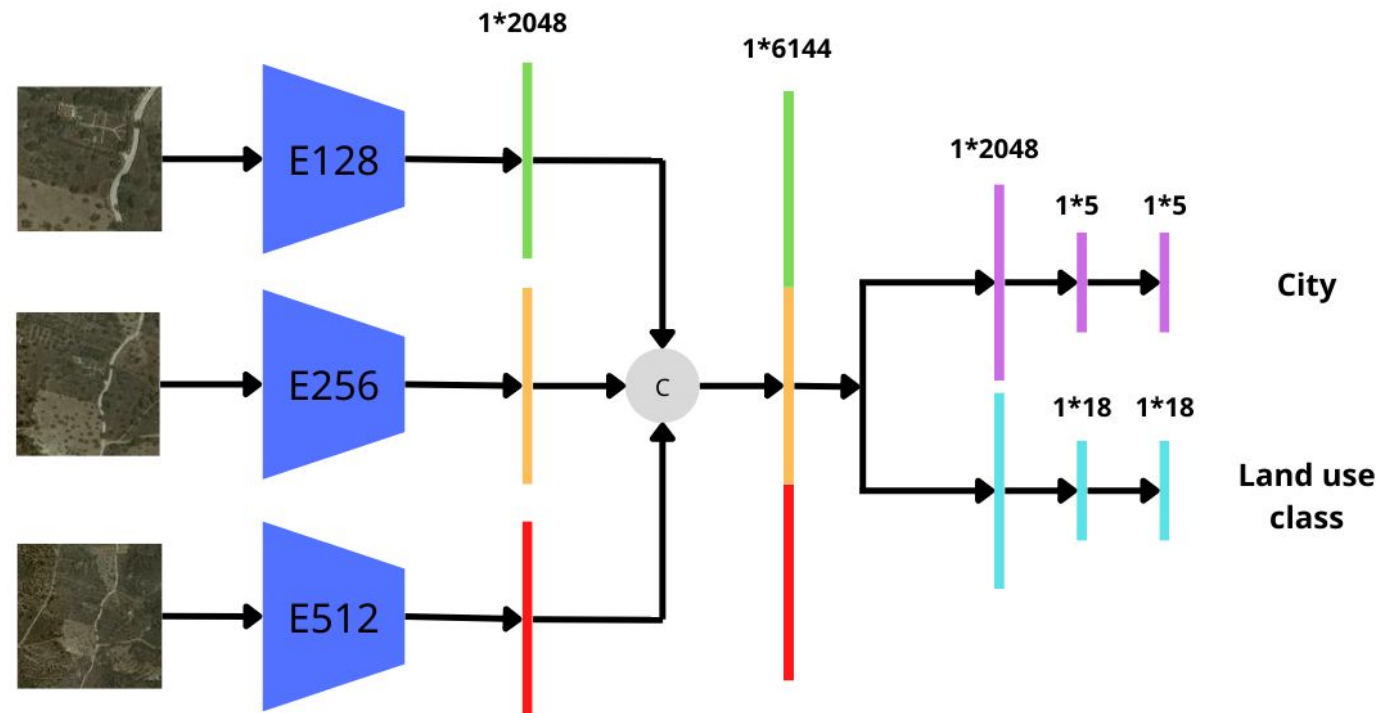


Dataset preparation



Methodology

1. Input multiscale satellite images
2. Feature extraction using CNNs (E128, E256, E512) outputs
3. Concatenate features and feed them to two classifiers
4. One output for each classification task



Challenges

- Get Open Street Map street network data matching the bounding box of satellite images
- Imbalanced data
 - too many agricultural areas
 - not a lot of airports
- Implement proposed neural network without all the details

Future work

- Finalise neural network
- Evaluate performance results on the two classification tasks
 - F1-score
 - Confusion matrices
- Compare with baselines E128, E256, E512
- Experiment with transfer learning
 - exclude one city from the training set
 - pretrain with small data sample
 - check performance of network

Questions?



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