ZEKI

Zentrum für erlebbare
Künstliche Intelligenz
und Digitalisierung e.V.

2023 Internship Group Presentations

Berlin, 31.08.2023

Topic Overview / Agenda

BeIntelli

1. TP2: AI Middleware - Edge Cloud
2. TP3: Extrinsic Camera and Lidar Calibration
3. TP3: Localization by Visual Place Recognition
4. TP3: Free Parking Space Detection
5. TP4: Smart Parking Recommendation
6. TP4: AI Platform and Tools

COBRA-5G

1. Pod/Container-Monitoring in K8s Clusters

Go-KI

1. Smart Fridge - Object Detection
2. Ground Assistance System - Voice Interaction

BeIntelli TP3

Localization by Visual Place Recognition

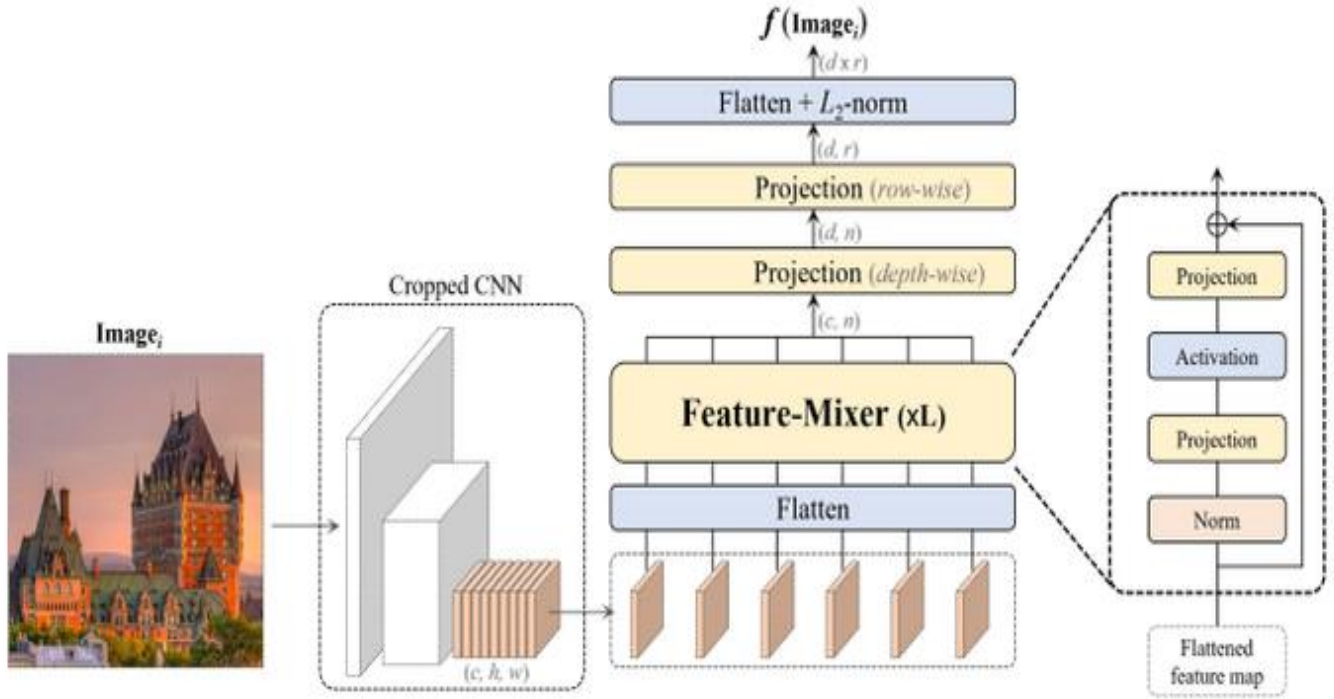
Group member:

- Ahmet Alperen Güngör

Supervisor:

- Ketan Motlag / Srinivas Ravuri

- To improve the initialization of the localization algorithm[1]
- Recognize environment by camera data using a NN-based regression model (MixVPR)[2]
- Locate where our vehicle is and output GNSS coordinates.



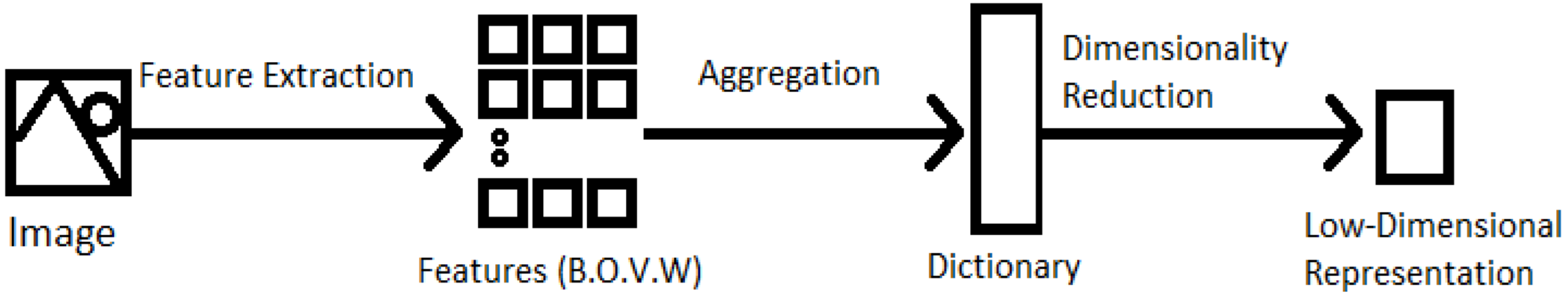
Literature Review - Manual Approaches:

Challenges:[3][4]

1)Viewpoint Change 2)Perceptual Aliasing 3)Appearance Change

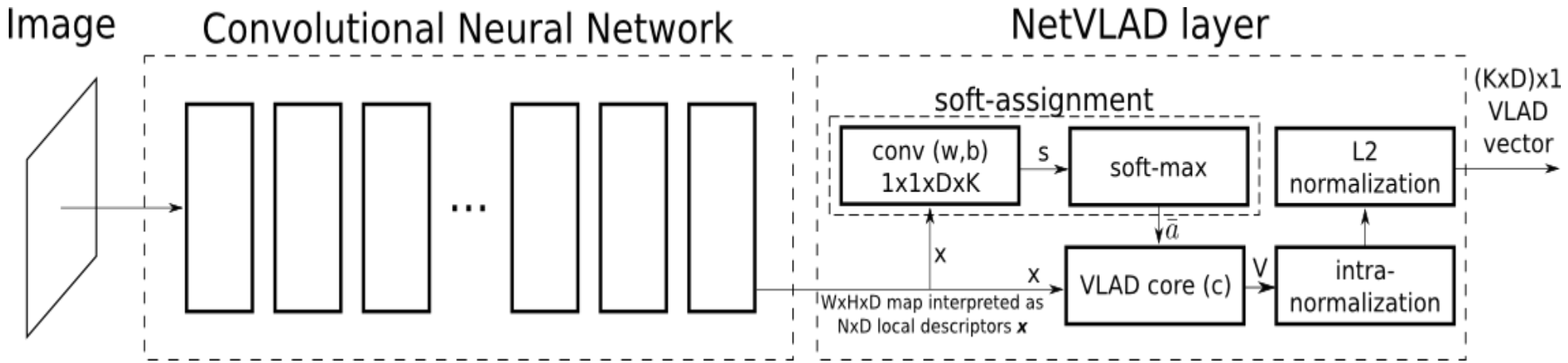
Process:

- Local (SIFT[5] /SURF[6]) or Global (GIST[7]) Feature Extraction
- Aggregation (VLAD[8][9])
- Dimensionality Reduction (PCA)

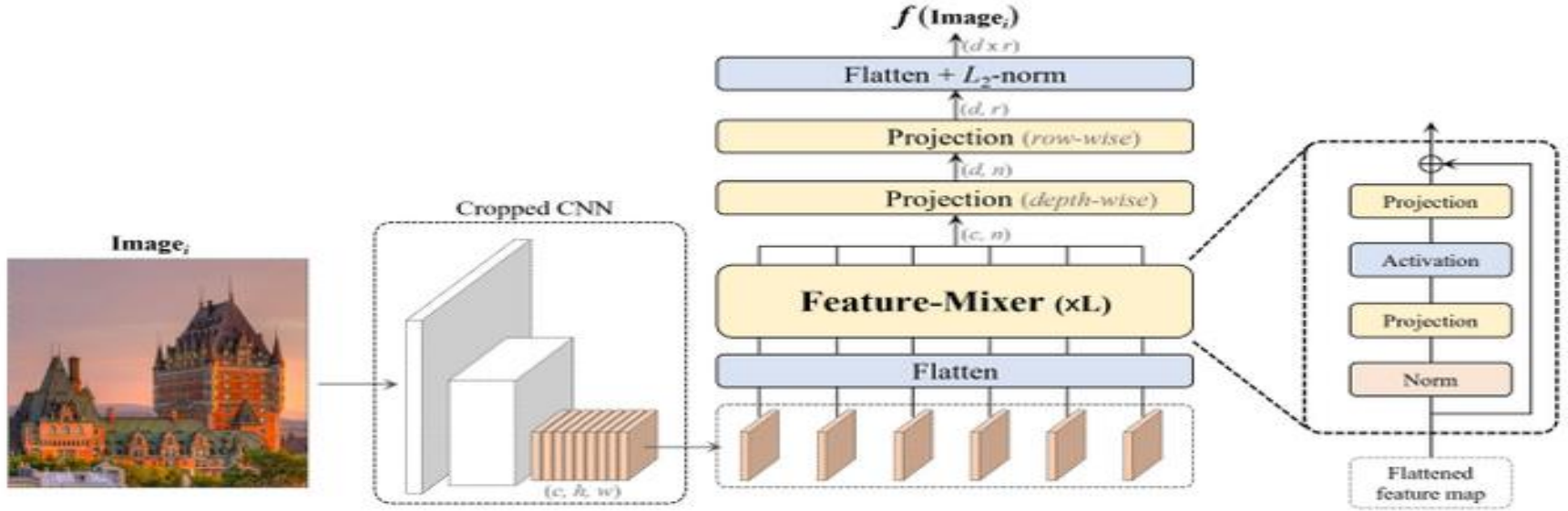


End-to-End Deep Learning Approaches:

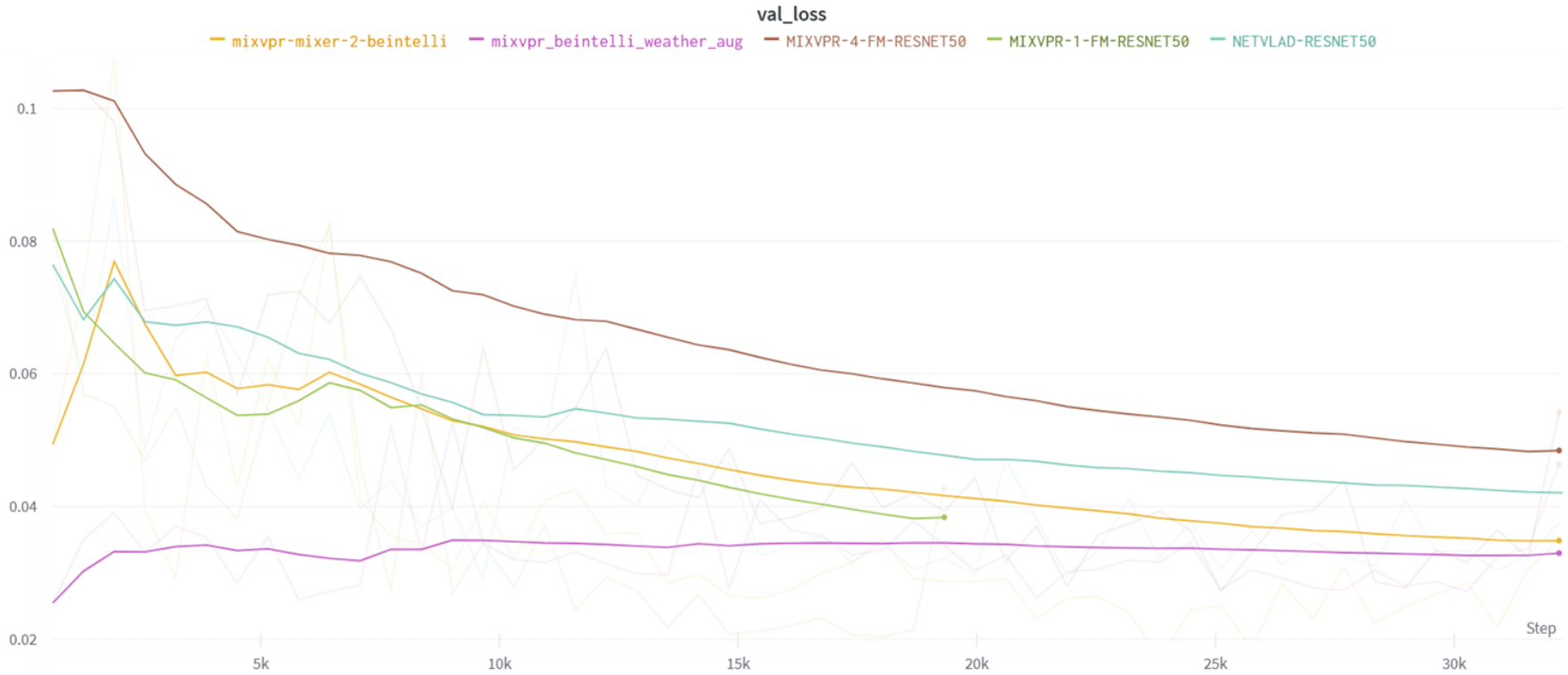
NetVLAD[10][11][12]**:**

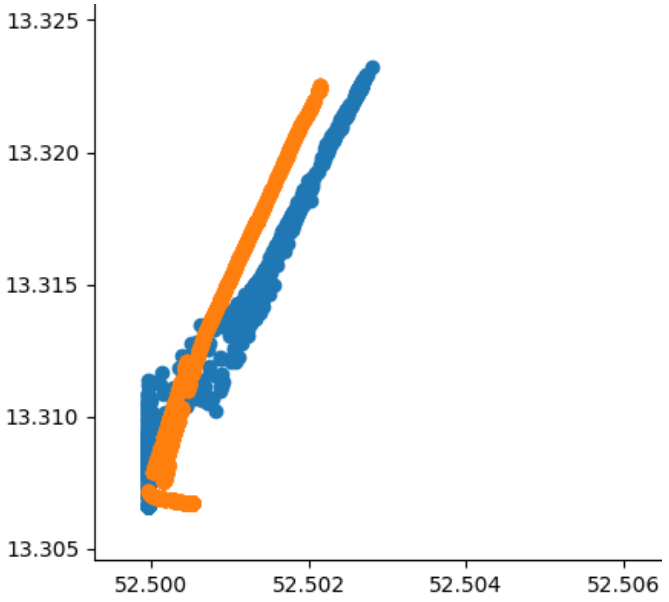


MixVPR:



Results:





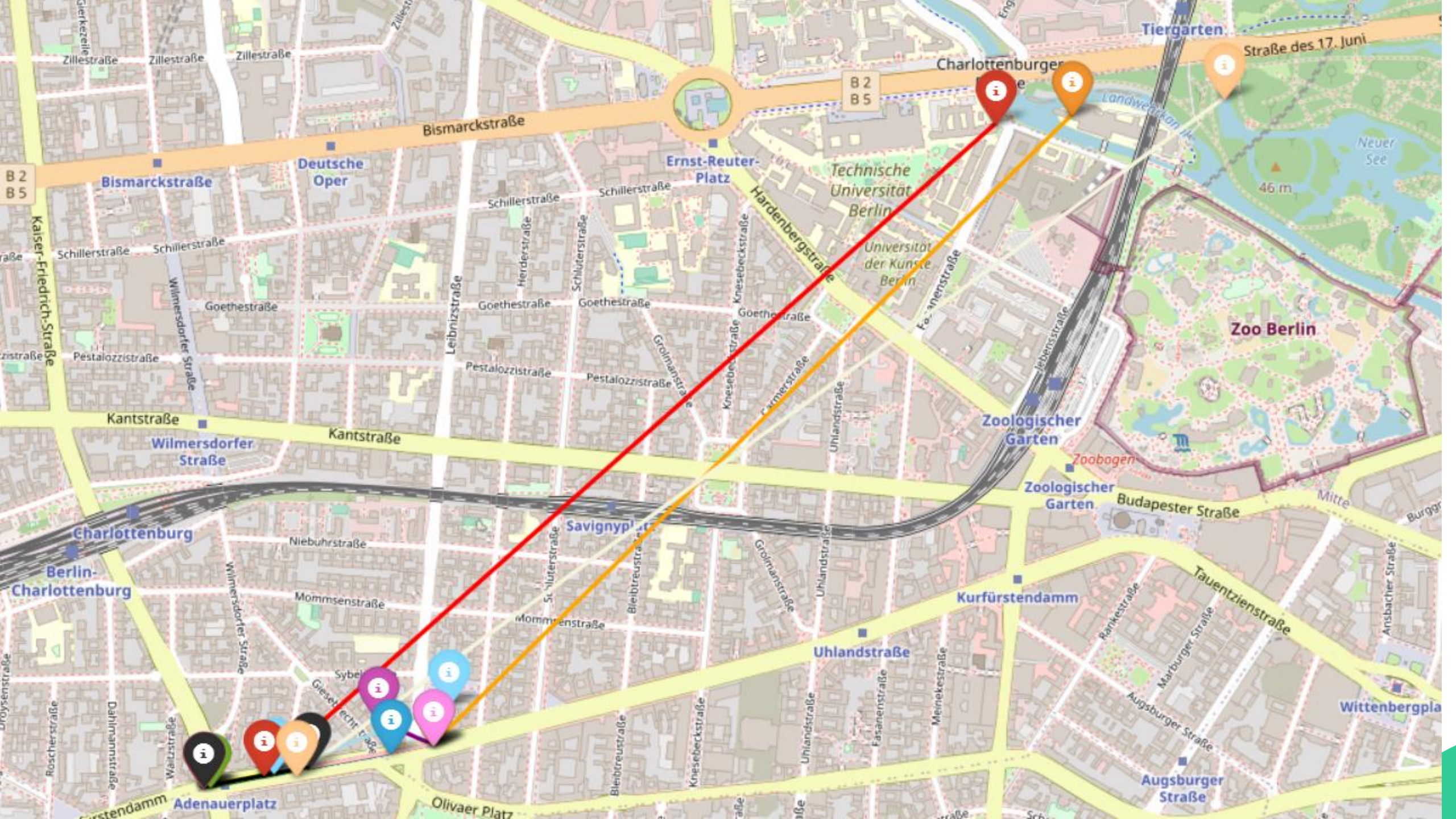
examples

pred: [52.50215322 13.32168739], target: [52.5019887 13.32144691]

pred: [52.50109027 13.31465805], target: [52.50082308 13.31404815]

pred: [52.50203281 13.3214075], target: [52.50212322 13.32229852]

pred: [52.50136279 13.31668175], target: [52.50134043 13.31736934]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B 2
B 5
Deutsche Oper
Ernst-Reuter-Platz
Technische Universität Berlin
Universität der Künste Berlin
Hardenbergstraße
Charlottenburger Straße
Tiergarten
Straße des 17. Juni
Landwehrkanal
Neuer See
46 m
Zoo Berlin
Zoologischer Garten
Zoobogen
Budapester Straße
Mitte
Kaiser-Friedrich-Straße
Schillerstraße
Goethestraße
Pestalozzistraße
Wilmersdorfer Straße
Leibnizstraße
Herderstraße
Schlüterstraße
Kantstraße
Wilmersdorfer Straße
Charlottenburg
Berlin-Charlottenburg
Savignyplatz
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Tauentzienstraße
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Ansbacher Straße
Adenauerplatz
Olivaer Platz
Roscherstraße
Dahlmannstraße
Waitzstraße
Giesebrechtstraße
Bleibtreustraße
Knesebeckstraße
Grolmanstraße
Meinekestraße
Fasanenstraße
Jebensstraße

Future Works:

- Increasing accuracy (less loss):
  - More hyperparameter tuning and testing with current MixVPR model
  - Instead of a basic CNN feature extraction, a more complex one such as attention-based transformers[13]
  - Improvements in feature-mixer layer - a more complex and accurate layer if possible

- Improved robustness to temporary and repeating objects like cars, humans and trees/buildings (ex. Zoo road and rural areas)[14][15][16]

- Combining RGB image data with lidar data[17]

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