Centre for Robotics

Email: s.hussaini@qut.edu.au
Code: https://github.com/QVPR/vpr-smr-predictor

Improving Visual Place Recognition with Sequence-Matching Receptiveness Prediction

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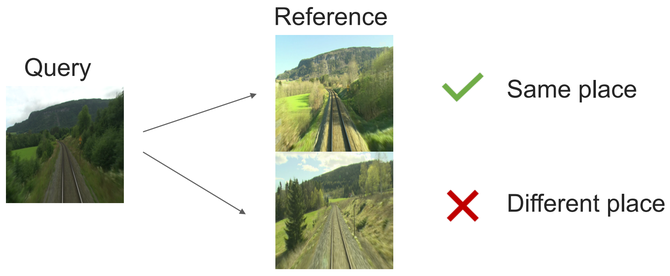
Visual Place Recognition Task

Given a query image, can we find the most similar reference image?



Motivation

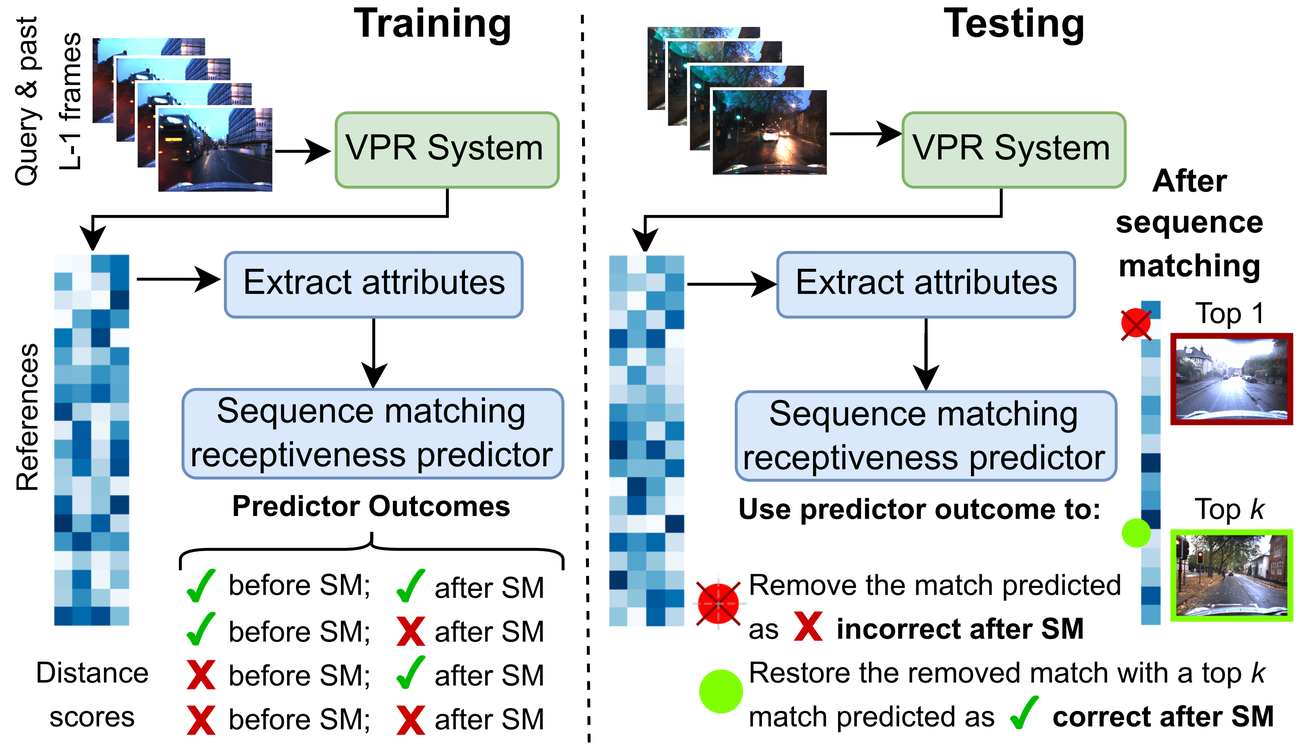
VPR performance suffers under **appearance change** (seasons, lighting, weather). **Sequence matching (SM)** helps but not always. Can we **predict when** sequence matching will help?

Goal

Predict **per-frame** if sequence matching helps. Improve VPR systems by **removing** unhelpful matches after sequence matching.

Method

Sequence matching receptiveness predictor



SMR predictor training:

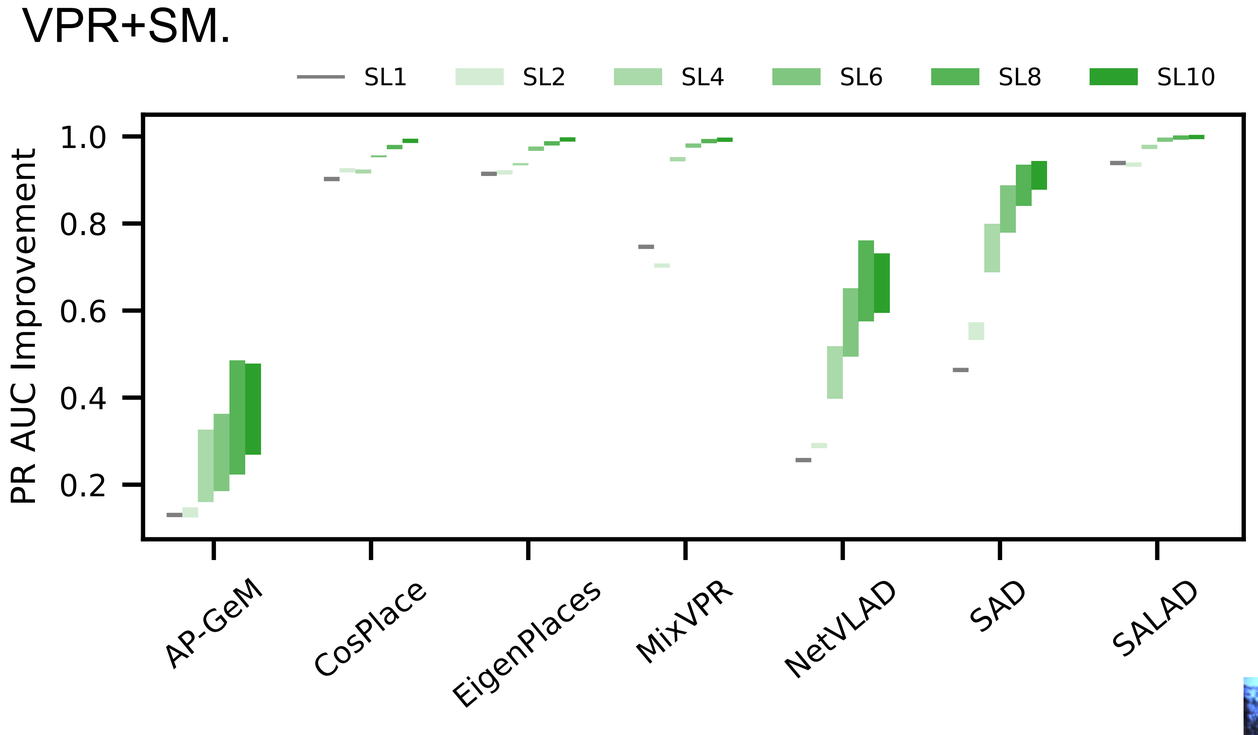
- Extract predictor attributes from the distance scores of query + past N frames (from training data).
- Train to predict match correctness after sequence matching.

SMR predictor testing:

- Extract predictor attributes from the distance scores of query + past N frames (from test data).
- Use predictor to predict match correctness after SM and use it for :
  - Remove predicted bad matches.
  - Optionally restore better ones.

Results

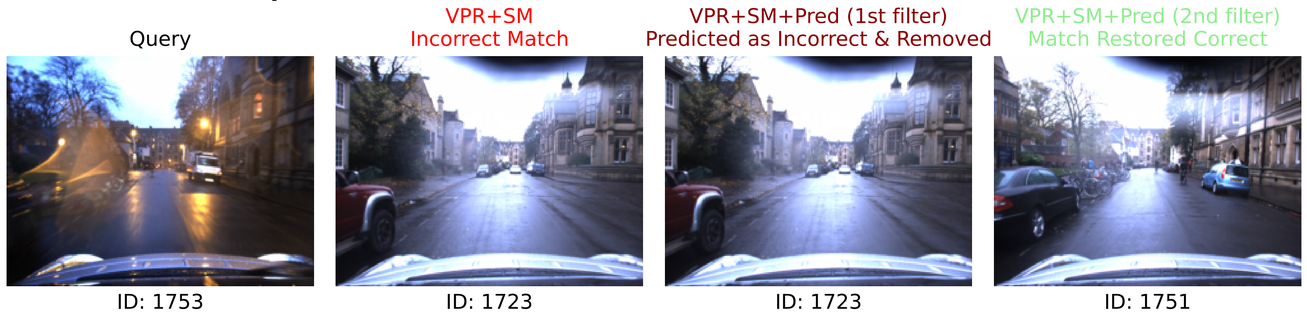
The effect of VPR+SM+Pred (first filter – match removal): Maintains/increases PR AUC at max recall compared to VPR+SM.



Average performance on Nordland, Oxford RobotCar and SFU-Mountains datasets across 7 VPR methods.

		Mean	Improved
Nordland	VPR+SM	0.1660	
	VPR+SM+Pred	0.1069	
	Reduction (%)	37.79	7 / 7
Oxford RobotCar	VPR+SM	0.0827	
	VPR+SM+Pred	0.0679	
	Reduction (%)	18.97	5 / 7
SFU Mountain	VPR+SM	0.0092	
	VPR+SM+Pred	0.0058	
	Reduction (%)	21.68	3 / 7

An example of Oxford RobotCar Query image, where the wrong match was predicted as incorrect and replaced with another top correct match.



Future Directions

- Apply predictor incrementally or online.
- Use transformers for better prediction.
- Optimise for real-time performance.
- Improve match restoration.

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