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Detector-Free Feature Matching for Visual SLAM
Evaluation of LoFTR and ELFOTR

Ahmet AJAM
518231020

BBL514e

Course Project

İTÜ

- ## Problem:

  Visual SLAM systems fail in low-texture or dynamic scenes with

 traditional methods (e.g. ORB, SIFT).

- ## Goal:

  Evaluate transformer-based detector-free feature matching models

  (LoFTR, ELFOTR) for robustness and SLAM suitability.

Ahmet AJAM

LoFTR

- No keypoints needed — predicts dense correspondences with transformers.

- Strong in textureless regions.

ELFOTR

- A faster and lighter version of LoFTR.

- Designed for real-time use (mobile or embedded SLAM).

LoFTR Model pipeline
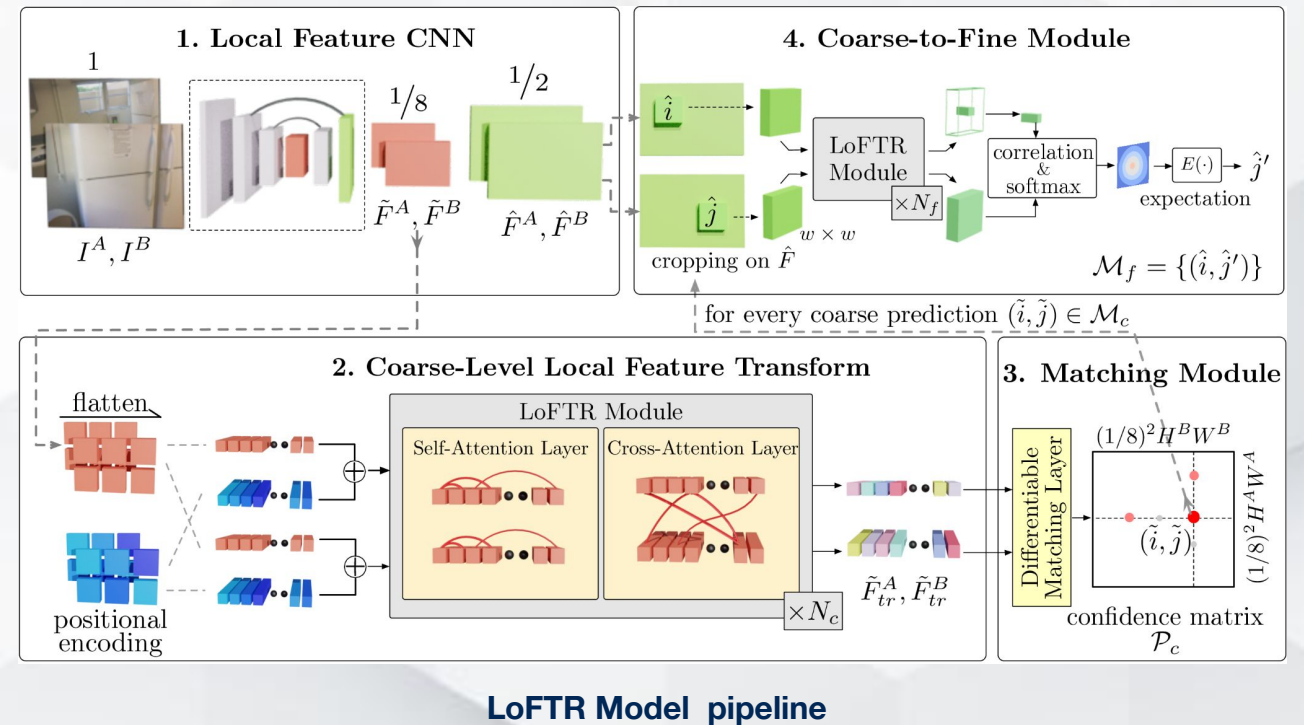
Feature	MegaDepth1500 (Outdoor)	ScanNet1500 (Indoor)
Type	SfM photos from the internet	RGB-D scans from real indoor scenes
Data	RGB, estimated depth, camera poses	RGB, real depth, normals, intrinsics
Use Case	Outdoor SLAM testing	Indoor SLAM & AR

- Pretrained **LoFTR** & **ELFOTR** evaluated on MegaDepth1500 and ScanNet1500.

- **Metrics:**
  - AUC@5/10/20 (homography accuracy)
  - Match Count
  - Precision@1e-4

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LoFTR:

- Stronger in outdoor scenes (MegaDepth AUC@20: 0.81)
- Good match precision

ELFOTR:

- Similar accuracy, faster
- Best overall precision (0.9687 on MegaDepth)

Dataset	AUC@5	AUC@10	AUC@20	Matches	Precision
ScanNet	0.1687	0.3363	0.5064	1456.24	0.6267
MegaDepth	0.5193	0.6921	0.8143	3458.37	0.9354

LoFTR Evaluation Results

Config	Dataset	AUC@5	AUC@10	AUC@20	Matches	Precision
Full	ScanNet	0.1965	0.3718	0.5369	1335.17	0.6505
Opt	ScanNet	0.1684	0.3384	0.5073	1505.35	0.5996
Opt	MegaDepth	0.5586	0.7186	0.8327	3288.18	0.9315
Full	MegaDepth	0.5638	0.7218	0.8348	3288.18	0.9687

ELFOTR Evaluation Results

- **Detector-free models** (esp. ELFOTR) are reliable for Visual SLAM.

- **ELFOTR** is better for real-time applications.

- Future work: Integrate into full SLAM systems (e.g. ORB-SLAM3).

Project Repository:

github.com/ajamiscoding/loftr-elfotr-project-bbl514e

Thank you!

Teşekkürler

Sunumu Hazırlayan