

Unsupervised fuzzy clustering for trajectory analysis

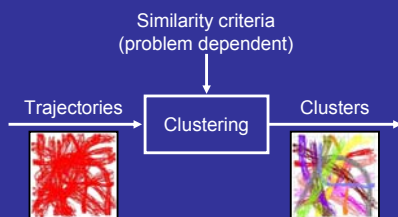
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1. Objective

To improve trajectory-based scene analysis

Applications:

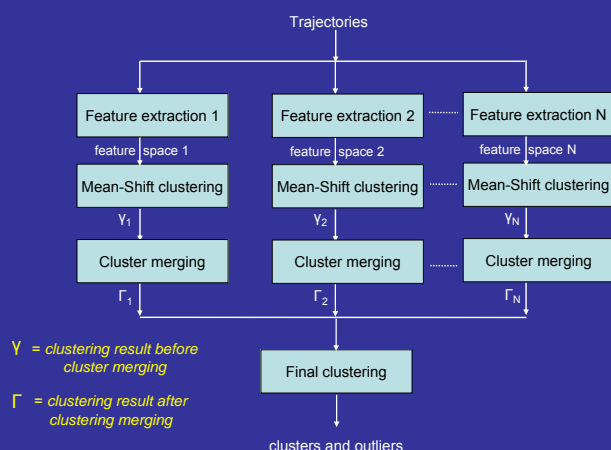
- Video surveillance
- Automotive systems
- Medical screening
- Autonomous robotics



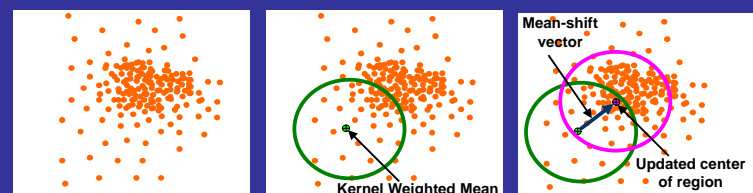
2. Proposed approach

- Multi-feature space analysis of trajectory data
- Mean-shift for local mode seeking → **tentative clusters** (in each feature space)
- **Final clusters** → after combining adjacent clusters (across all feature spaces)
- **Sparse clusters** → Outlier behaviors

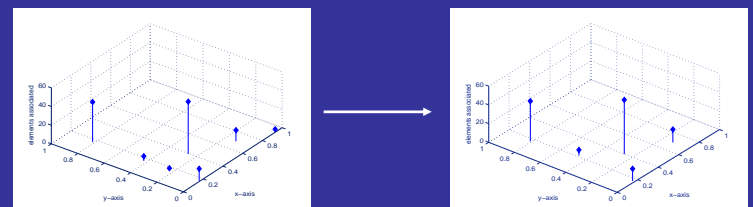
3. Fuzzy clustering using Mean-shift (FMS)



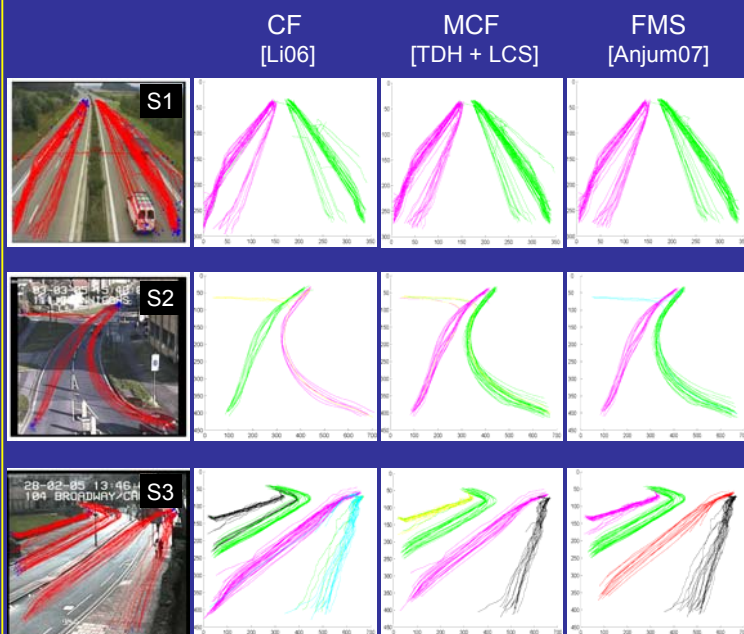
3.1 Mean-shift



3.2 Clusters merging



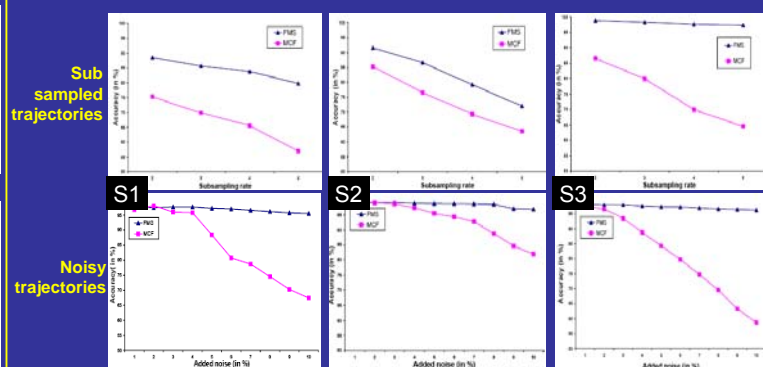
4. Results



5. Evaluation

Algo.	S1		S2			S3				Avg.
	C1	C2	C1	C2	C3	C1	C2	C3	C4	
FMS	98.24	97.81	99.45	99.87	97.37	99.96	94.10	99.87	99.85	98.50
CF	97.31	94.23	99.41	92.27	96.57	96.87	93.68	98.65	85.43	94.93
MCF	98.90	97.32	99.54	99.70	98.13	93.12	98.88	99.93	95.02	97.84

Robustness comparison:



6. Conclusions

- We proposed a trajectory clustering algorithm based on unsupervised Mean-shift followed by fuzzy clustering on the first two components (PCA) + average velocity vector
- The algorithm was validated on real outdoor traffic scenarios from standard test sequences and compared with state-of-the-art approaches.
- The results show that the proposed algorithm is more robust to noise and to variations in the frequency of object observations.

7. References

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