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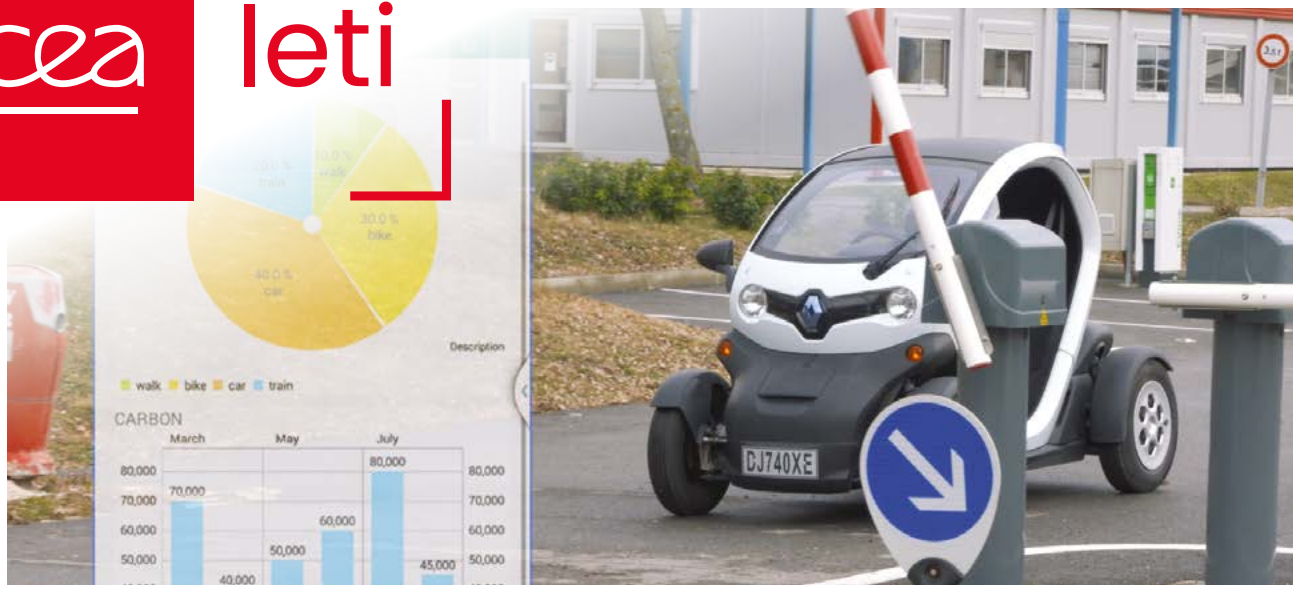

Mobility Observer

Automatic fine-grained transport mode recognition for wearable-based mobility applications

What is Mobility Observer?

Transport Mode Recognition is a data fusion process, which:

- Classifies automatically a person's or object's transport mode while on the go
- Leverages various measurements provided by sensors typically integrated into smartphones and wearables

Classification level refinement allows:

- Differentiation between similar usage cases, e.g. detailed rail or road transport modes, while retaining device autonomy

Applications

Fine-Grained Transportation Mode Recognition is a must-use tool to improve applications for intermodality, social and urban sensing uses and energy efficiency.

- Carbon footprint estimation
- Tool for monitoring and encouraging green mobility
- Real-time door-to-door smart planning
- Smart mobility monitoring
- Mobility behaviour analysis for specific social groups
- Observer of personal movement capability (e-health)
- Driving analysis
- Road user analysis and collision prevention
- Goods mobility tracking
- Mode-centric services and applications

What's new?

- Fine-grained transportation mode recognition including car, bus, train, subway, etc.
- Use of large publicly available database (Geolife, Sussex-Huawei Locomotion Dataset, etc.) in order to test and implement Deep Learning approaches

How does it work?

- Sensor data mining for key power-efficient characteristic extraction
- Shallow or Deep learning classification

Confusion Matrix

		Bike	Bus	Car	Subway	Train	Walk	f1-score
Truth	Bike	482	39	13	18	0	65	0.79
	Bus	48	675	172	43	4	54	0.74
	Car	51	104	643	28	37	43	0.66
	Subway	10	16	10	167	3	27	0.67
	Train	1	2	9	8	351	5	0.91
	Walk	5	0	0	1	0	1540	0.94

Observer prediction accuracy on Geolife Dataset: confusion matrix with data ranging from true (rows) to predicted values (columns).

What's next?

- Model adaptation using Transfer Learning
- Improving prediction accuracy thanks to fusion with:
  - Static (e.g. bus map) and dynamic context (position, speed, etc.)
  - a priori assumptions about the succession of temporal modalities

CEA-Leti researchers continue to pioneer affordable, innovative, smart solutions for users and operators in the global mobility market by fusing sensors, increasing Observer performance, device autonomy and developing crowd sensing functionality.

CEA-Leti's approach embraces:

- Specification of requirements (classified mode output, latency, autonomy, etc.)
- Creation or completion of dedicated database
- Integration, testing and transfer to industry.

Publications

- [1] A. Vassilev, "Data Mining Applied to Transportation Mode Classification Problem", 4th International Conference on Vehicle Technology and Intelligent Transport Systems, 2019.
- [2] A. Vassilev, "Reconnaissance des modes de transport par apprentissage profond à partir de signaux GPS", GRESTI 2019.

How do we work together?

- Requirements specification (classified mode output, latency, autonomy)
- Creation or completion of dedicated database
- Data Fusion
- Integration, tests and transfer to industry

Interested in this technology?

Contact:
Swan Gerome
swan.gerome@cea.fr
+33 438 784 624

CEA-Leti, technology research institute
17 avenue des Martyrs, 38054 Grenoble Cedex 9, France
cea-leti.com

@CEA-Leti

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