

#### Near Real-Time Transportation Mode Detection Based on Accelerometer Readings

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### Motivation

- APIs already support fine-grained classification of nonmotorized forms of transportation (still, walking, running, cycling, and in vehicle)
- Not enough for tracking and routing purposes, specially in use-cases for urban environments



<sup>©</sup> Google Maps

#### Sensors

- Accelerometer, gyroscope, light sensor, proximity sensor, magnetic field sensor ...
- High precision and sampling frequency
- Useful in monitoring three-dimensional device movement, positioning, and user's activity detection

## Data input

- Accelerometer vs. GPS signal
- Three physical axes (x, y, z) with sampling rate 100Hz
- Approximately 20 hours of travelling measurements:

Car	Bus	Train	Motorbike
57%	32%	11%	0.1%

### Preprocessing

Split the recorded accelerometer signal into smaller (5s) pieces



# Gravity estimation

- Gravity is measured together with the dynamic acceleration caused by phone movements
- Average over all measurements in 1s interval



# Feature extraction and classification



#### Evaluation

# One against the rest

- Results for binary classification
- 10-fold cross-validation

	Accuracy	Precision	Recall	F1 score
Car	0.855	0.852	0.910	0.880
Bus	0.720	0.620	0.694	0.655
Train	0.876	0.726	0.671	0.697

# All pairs

#### Accuracy / F1 score for binary classification

	Car	Bus	Train
Car		0.848/0.889	0.943/0.962
Bus	0.856/0.832		0.858/0.896
Train	0.934/0.883	0.815/0.760	

### Multi-class classification

#### One versus the rest

Τ\Ρ	Car	Bus	Train	UC
Car	0.818	0.012	0.008	0.162
Bus	0.198	0.219	0.072	0.511
Train	0.118	0.042	0.344	0.496

#### All pairs

Τ\Ρ	Car	Bus	Train
Car	0.893	0.088	0.019
Bus	0.282	0.573	0.145
Train	0.167	0.162	0.671

Accuracy	0.803
Precision	0.784
Recall	0.401
F1 score	0.535

Accuracy	0.832
Precision	0.727
Recall	0.712
F1 score	0.716

### Conclusion

- It is possible to detect transportation mode using support vector machine with short readings of accelerometer signal
- Future work: collect more data, improve binary classification and explore other policies for combining multiple binary classification results