



# Imputing transportation modes from GPS Data in a motorcycle dependent area

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12<sup>th</sup> ISCTSC in Portugal (20-25 March 2022)

# #86 - IMPUTING TRANSPORTATION MODES FROM GPS DATA IN A MOTORCYCLE-DEPENDENT AREA

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## Introduction

Mode detection methods are the key to deploying GPS in travel demand survey.

- Little, however, is known about the potential and barriers to mode imputation from GPS in developing countries.
- This study aims to impute travel modes from GPS data in combination with socio-demographics of respondents in Hanoi (Vietnam) - a motorcycle-dependent city.

## Experimental description

- App: TRavelVU
- Time: 18/03 – 15/04/2020
- Place: Hanoi
- After filtering, used GPS data of 63 persons.

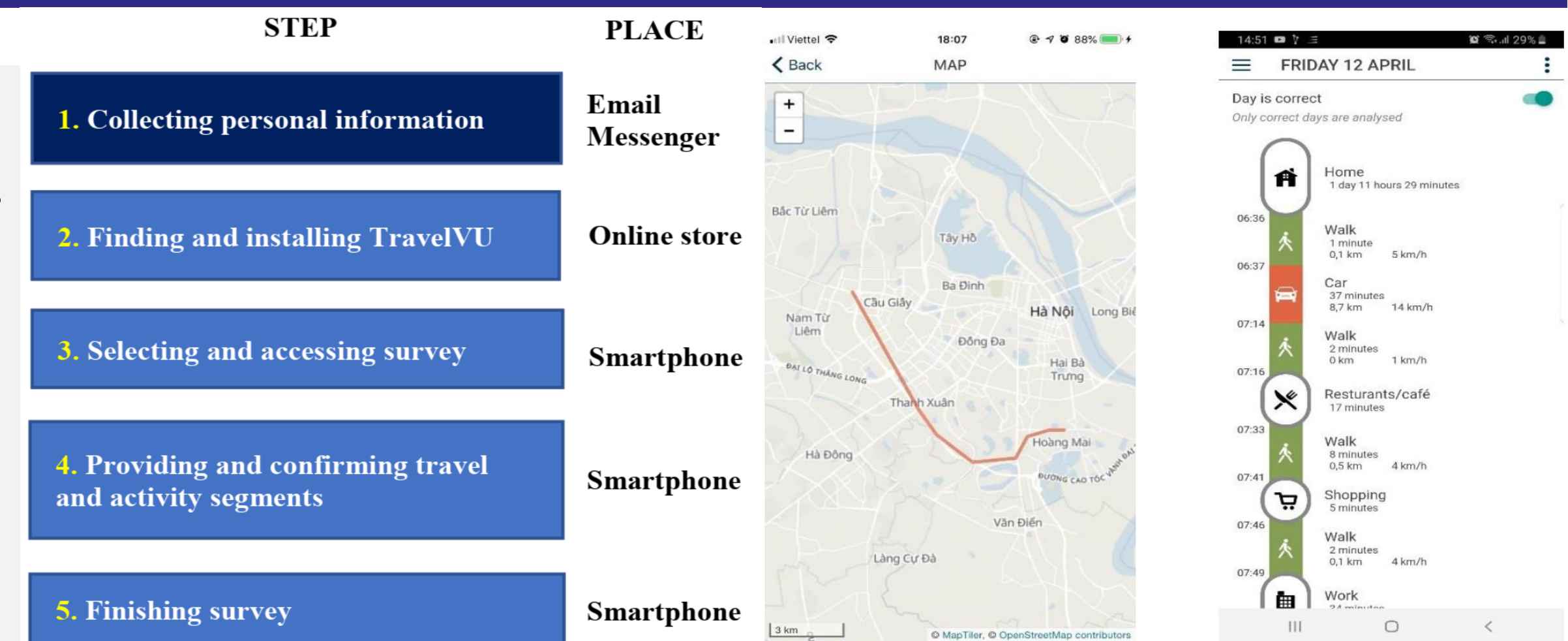


Fig 1. Survey process and app TRavelVU

## Methodologies and results

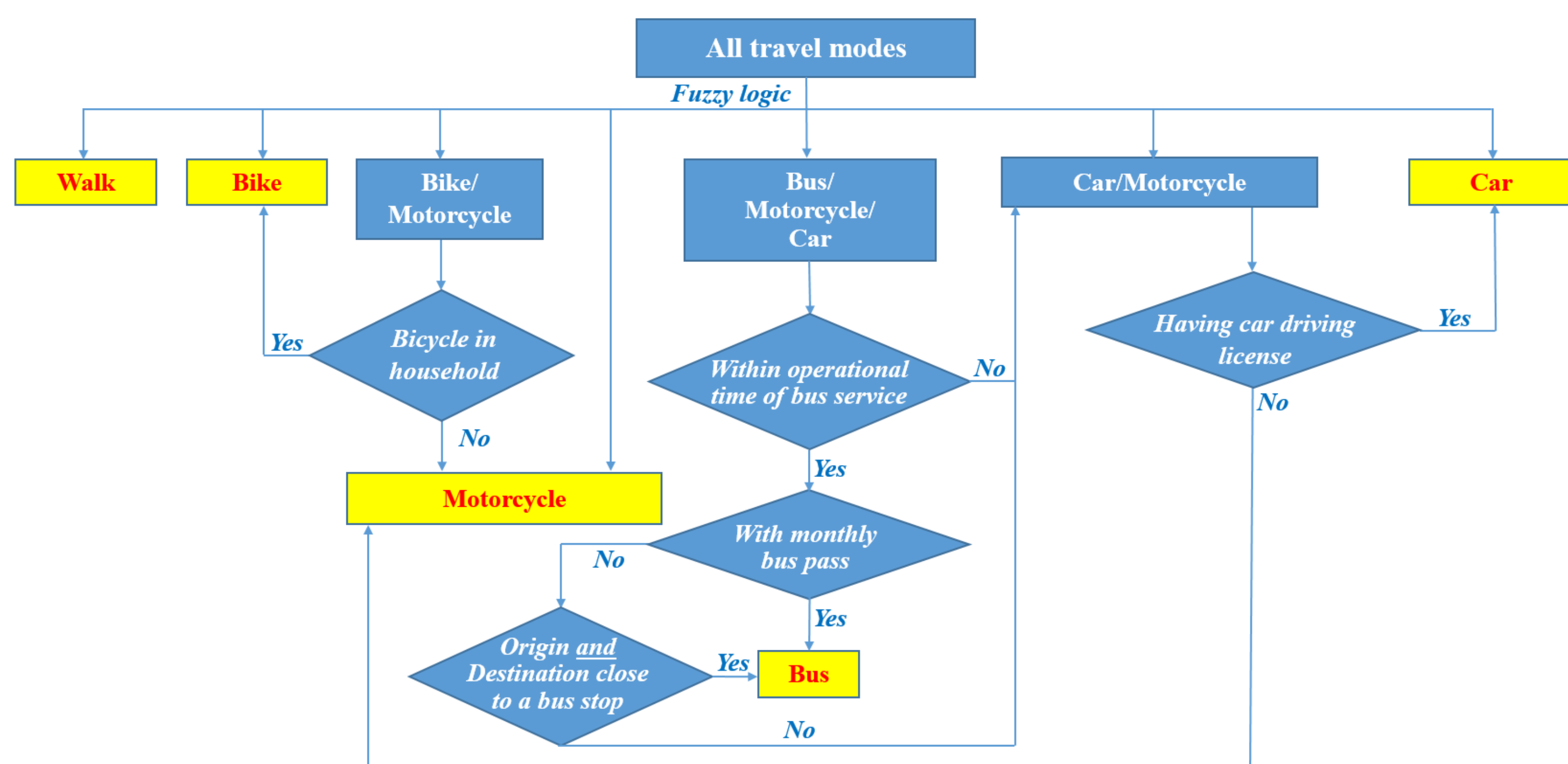


Fig 2. Process of travel mode imputation

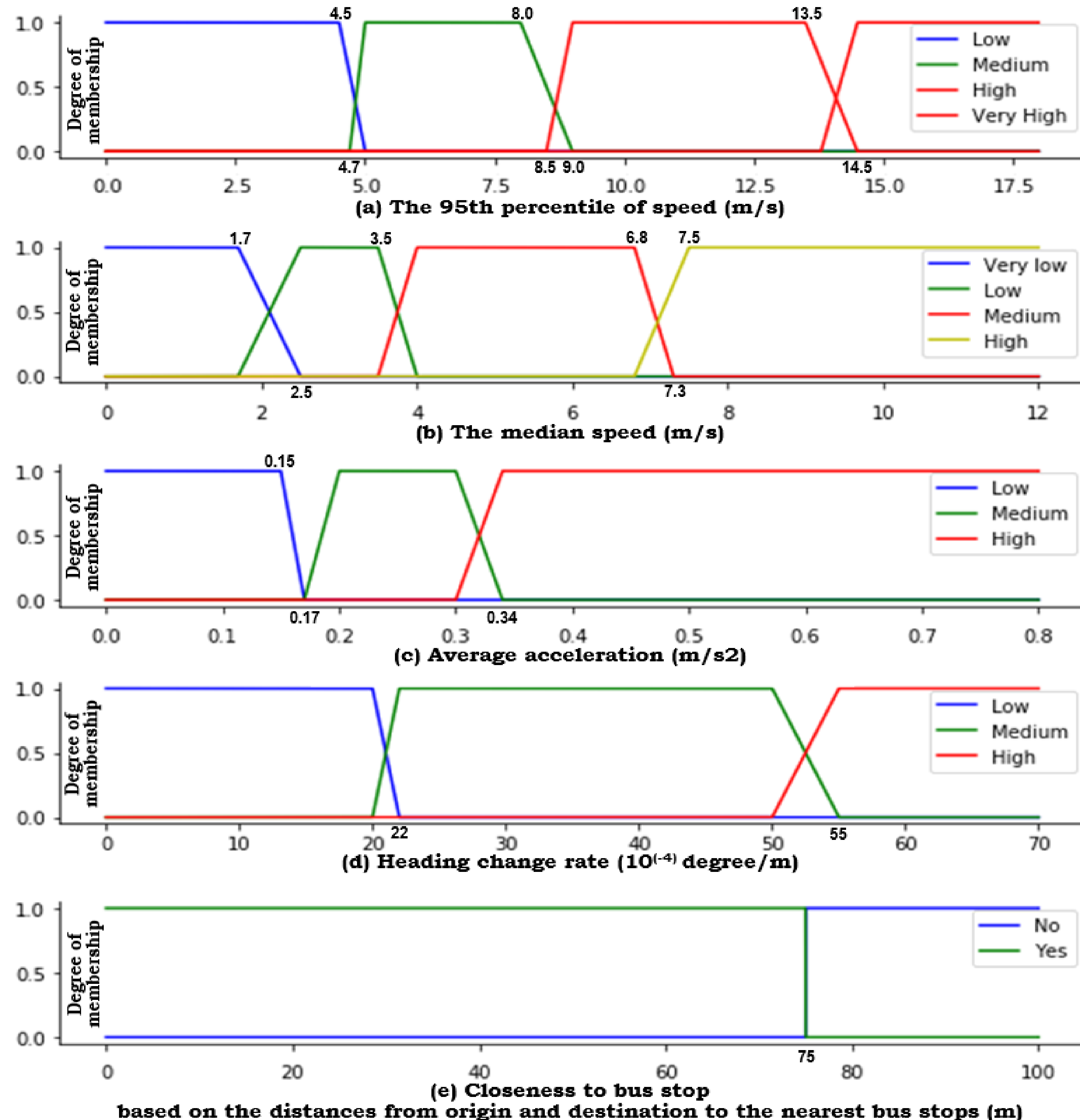


Fig 3. Membership functions of fuzzy variables

## Conclusions

- Among first studies of detecting travel modes from GPS data in a motorcycle-dependent city of a developing country.
- Inclusion of motorcycle increases the difficulty of mode detection challenge.

Tab 1. Confusion matrix of imputation results

		Predicted						Recall
		Walk	Bike	Bus	Motorbike	Car	Total	
Actual	Walk	719	9	0	28	2	758	94.9%
	Bike	4	75	0	23	2	104	72.1%
	Bus	0	2	72	21	2	97	74.2%
	Motorbike	48	33	36	1058	70	1245	85.0%
	Car	11	5	10	117	444	587	75.6%
	Total	782	124	118	1247	520	2791	
Precision		91.9%	60.5%	61.0%	84.8%	85.4%	Acc.	84.8%

### Process of mode detection (Fig 2.)

- Applying fuzzy logic (Fig 3.) to detect:** (1) walk, (2) bike, (3) car, (4) bike/motorcycle, (5) bus/motorcycle/car, (6) car/motorcycle.
- Post-processing to further detect:**
  - Bike/motorcycle:** A bike/motorcycle segment was classified as a bike one in case the traveler came from a household with at least one bicycle.
  - Car/motorcycle:** In case the user had a car driving license, the car/motorcycle segment was labelled as a car segment. If not, it was categorized as a motorcycle one.
  - Bus/motorcycle/car:** First, in case both the starting time and ending time of a bus/motorcycle/car segment felt into the operational time of bus services, this segment was then checked by two criteria. In case the user had a monthly pass or both origin and destination of this segment was close to bus stops, it was classified as a bus segment. By contrast, it was next treated as a motorcycle/car segment.

### Mode imputation results (Tab 1.)

- Reasonable overall accuracy of 84.8%.
- Motorcycles are the main source of misclassification.
- Imputations of bus and bike are poorer (see precision and recall)

### Future direction

- Improving the detection of bus and bike using machine learning

## Our related publications

- Nguyen, M.H., Armoogum, J., 2020. Hierarchical process of travel mode imputation from GPS data in a motorcycle-dependent area. *Travel Behav. Soc.* 21, 109–120. <https://doi.org/10.1016/j.tbs.2020.06.006>
- Nguyen, M.H., Armoogum, J., Adell, E., 2021. Feature Selection for Enhancing Purpose Imputation using Global Positioning System Data without Geographic Information System Data: *Transp. Res. Rec.* 2675, 75–87. <https://doi.org/10.1177/0361198120983006>
- Nguyen, M.H., Armoogum, J., Madre, J.-L., Garcia, C., 2020. Reviewing trip purpose imputation in GPS-based travel surveys. *J. Traffic Transp. Eng. Engl. Ed.* 7, 395–412. <https://doi.org/10.1016/j.jtte.2020.05.004>