



# Agent-Based Modelling for Social and Behavioural Dynamics and Impact Assessment

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**Aim** - This study aims to improve the accuracy of modeling human behavior by utilizing GPS data along with mathematical models and advanced machine learning algorithms within Agent-based Models (ABMs). This model helps us understand how policy changes impact social cohesion, mental health, and the environment.

### Application

#### Urban planning

Traffic Simulation  
Land Use Planning  
Disaster Preparedness

#### Epidemiology

Disease Spread Modeling  
Vaccination Strategies  
Healthcare Resource Allocation

#### Economics

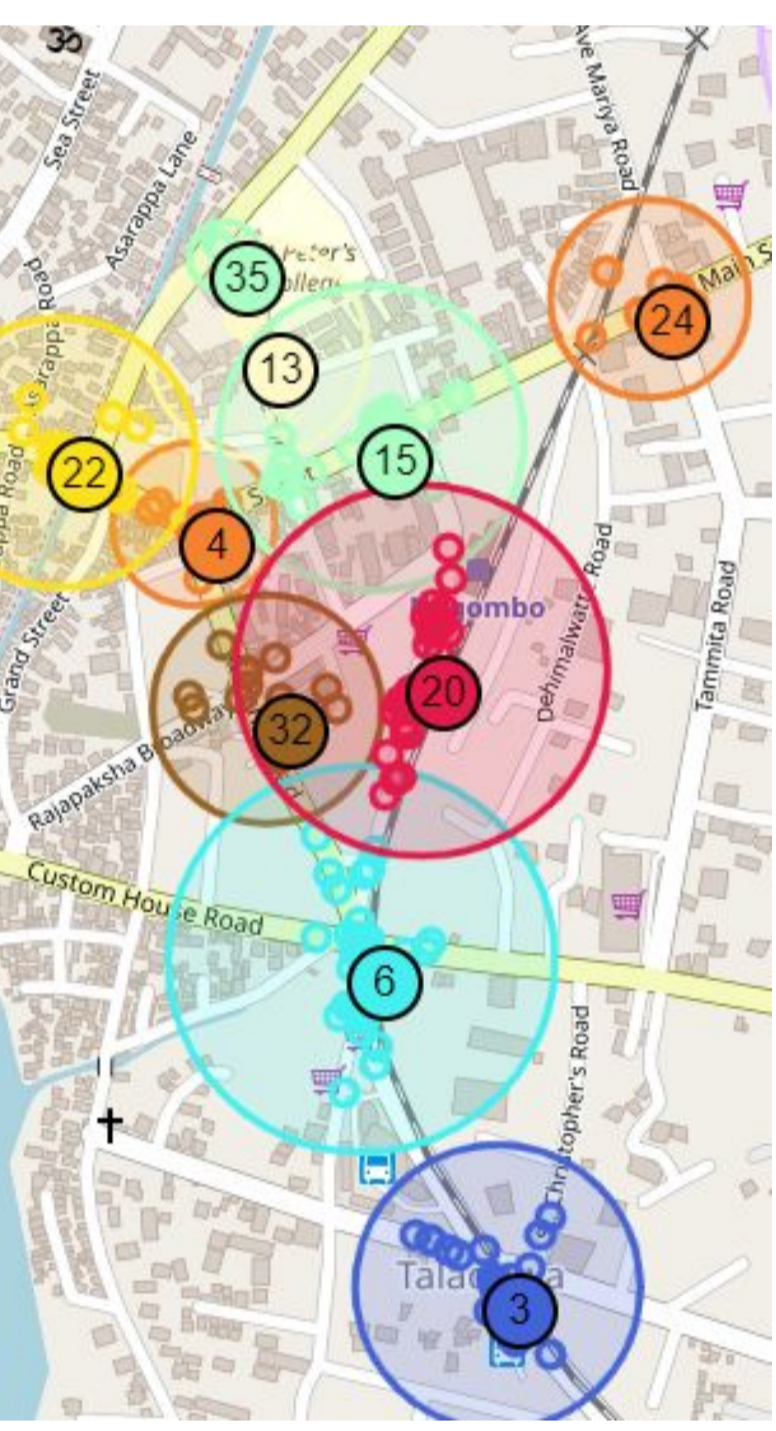
Market Dynamics  
Consumer Behavior  
Policy Analysis

### Research Journal DOI:10.3390/su15141120

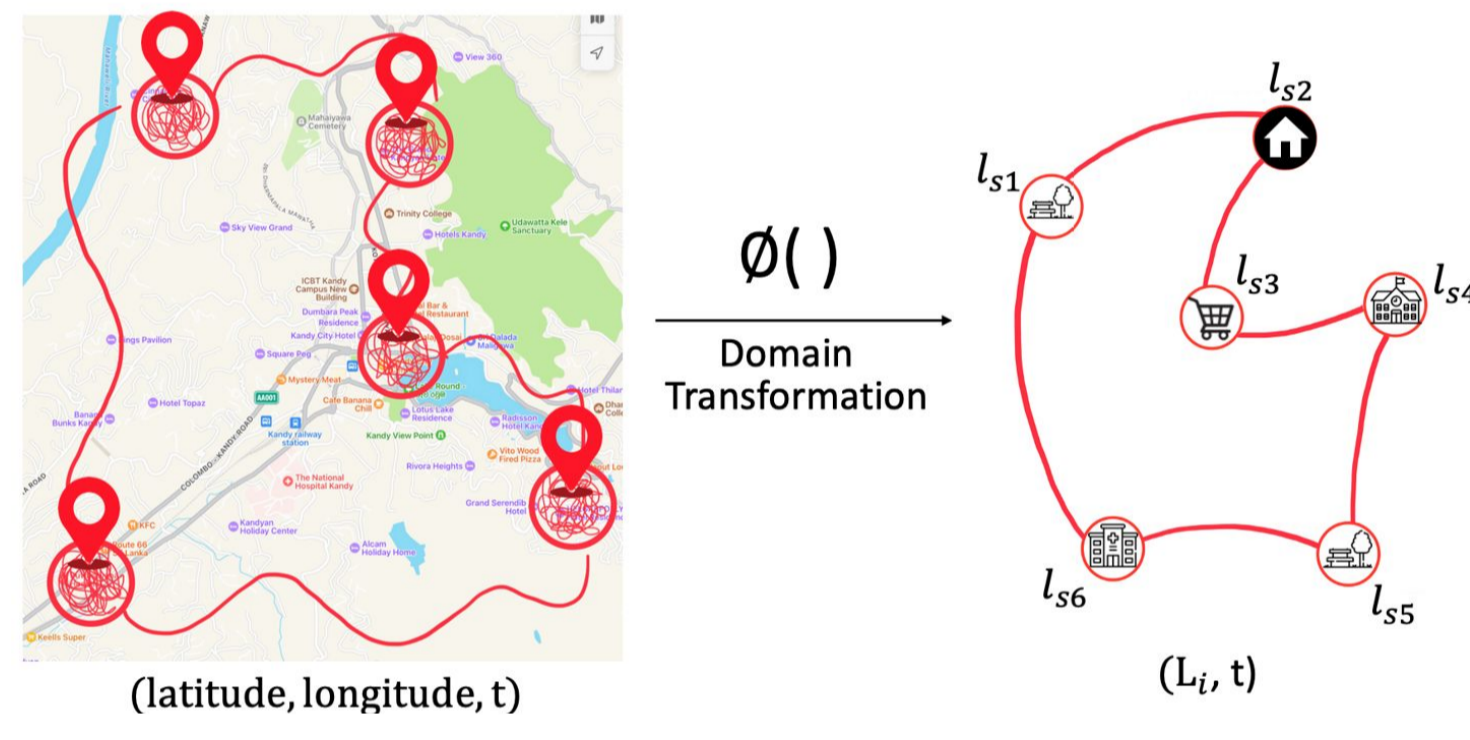
#### Pandemic Simulator: An Agent-Based Framework with Human Behavior Modeling for Pandemic-Impact Assessment to Build Sustainable Communities

by Harshana Weligampola <sup>1</sup>, Lakshitha Ramanayake <sup>2,†</sup>, Yasiru Ranasinghe <sup>3</sup>, Gayanthi Ilangarathna <sup>4</sup>, Neranan Senarath <sup>2</sup>, Bhagya Samarakoon <sup>2</sup>, Roshan Godaliyadda <sup>2</sup>, Vijitha Herath <sup>2</sup>, Parakrama Ekanayake <sup>2</sup>, Janaka Ekanayake <sup>2</sup>, Muthucumaru Maheswaran <sup>5</sup>, Sandya Theeminulle <sup>6</sup>, Anuruddhika Rathnayake <sup>7</sup>, Samath Dharmaratne <sup>7</sup>, Mallika Pinnawala <sup>8</sup>, Sakunthala Yatigammana <sup>8</sup> and Ganga Tilakaratne <sup>9</sup>

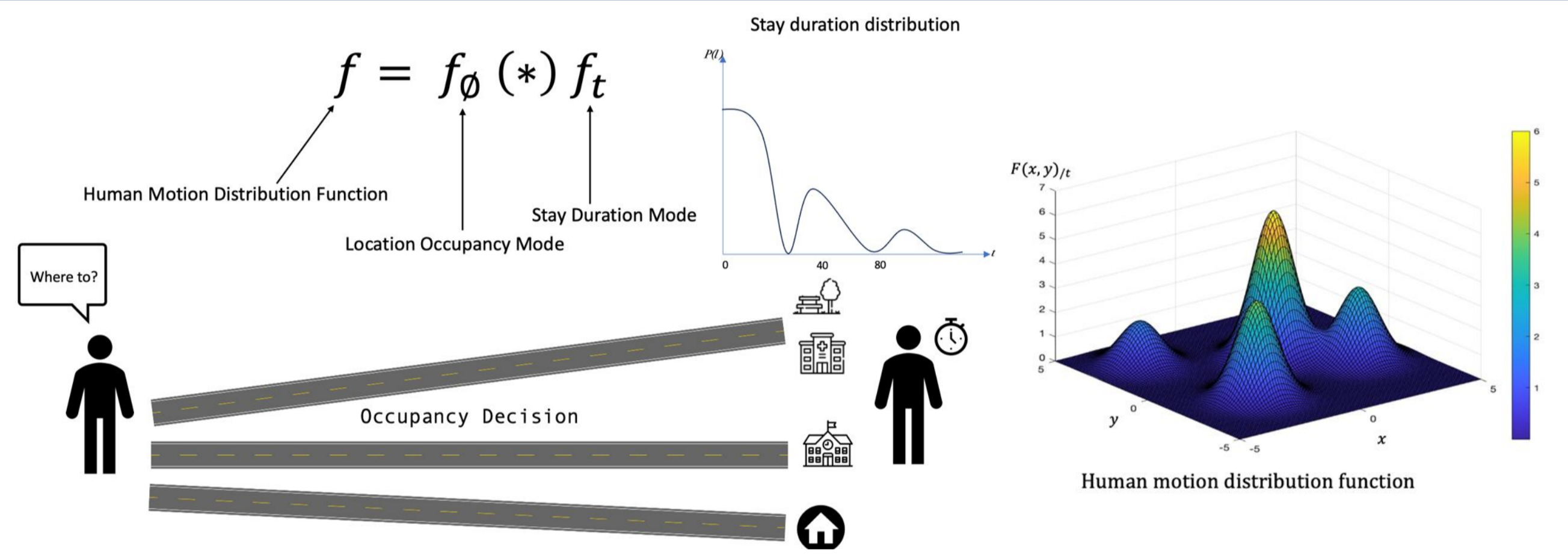
## Preprocessing and Domain Transformation



Gather GPS data from individuals across various professions and plot it on a map. Then apply **DBSCAN** clustering and label the resulting clusters into predefined location classes.



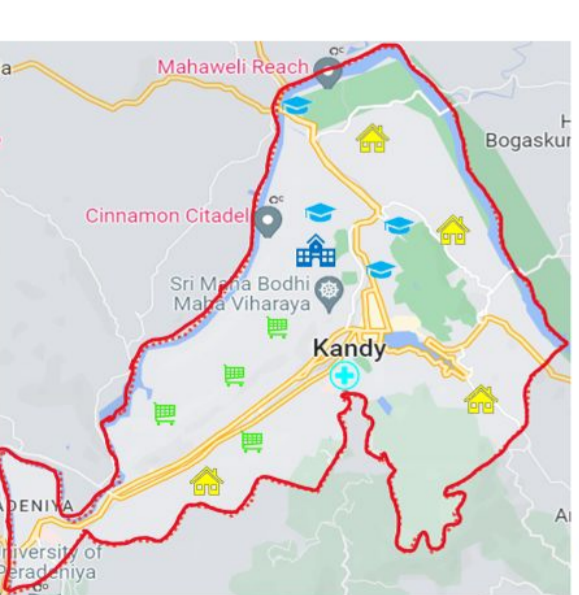
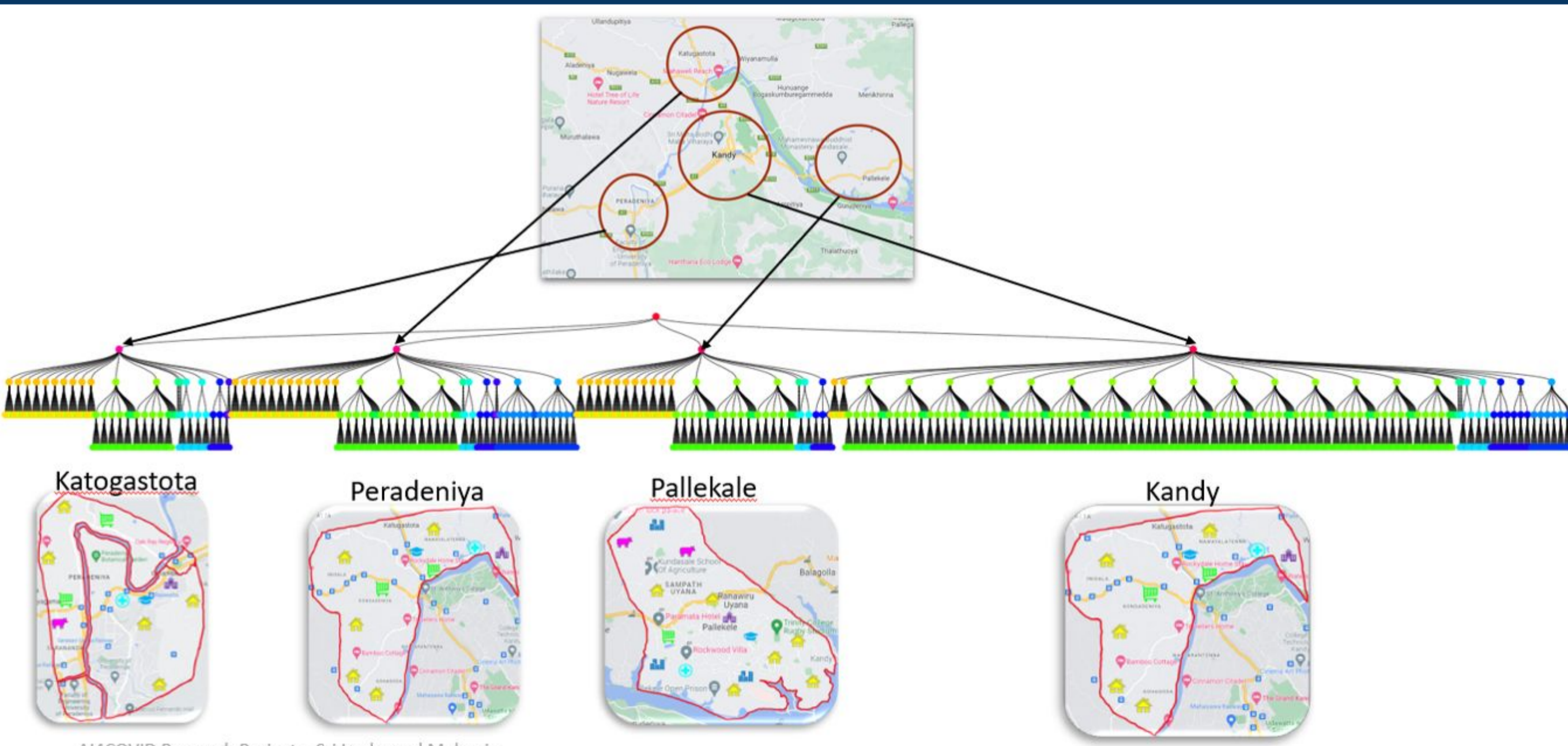
## Motion Distribution Model



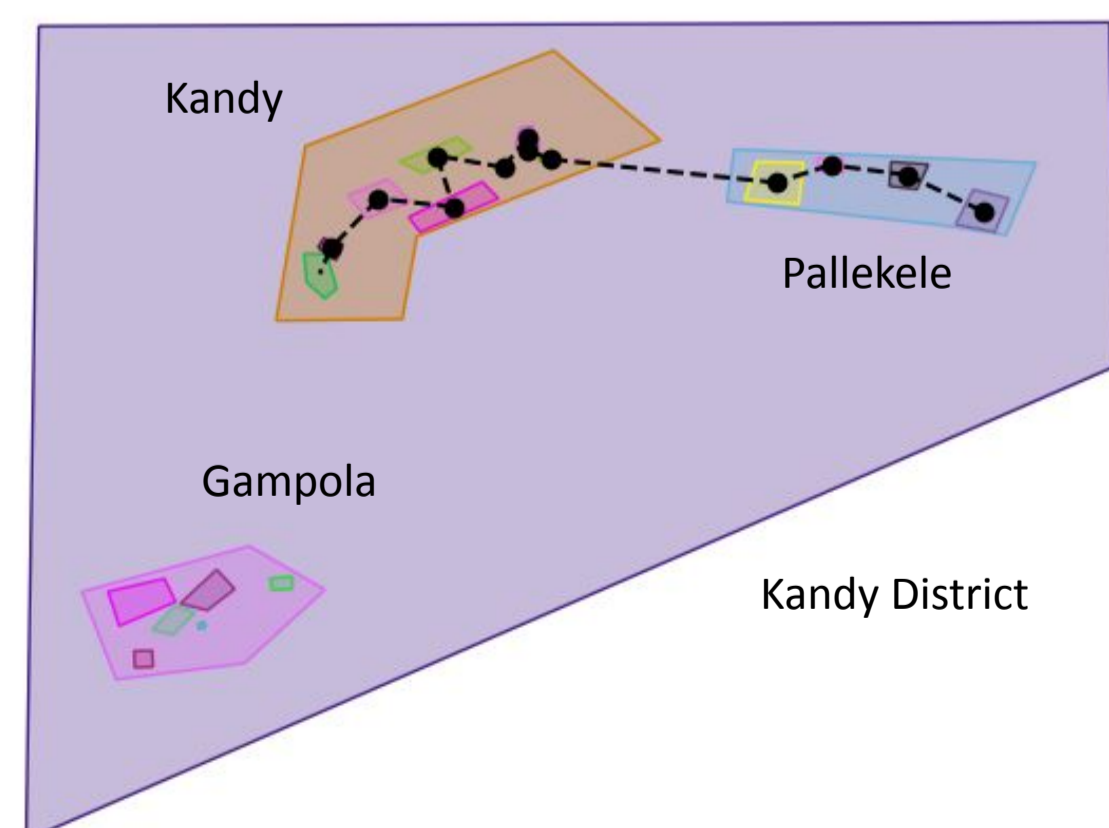
When at a specific location state: based on 'Stay Duration Mode', time spent on random walk state are estimated.

When stay duration expires: based on 'Location Visit Mode', the decision on next Location state is generated.

## Environment Builder



**Kandy town**  
Residential areas - 2 (Red)  
Commercial & Financial areas - 15 (Yellow)  
Medical zone - 2 (Blue)  
Educational zone - 2 (Green)  
Administrative zone - 2 (Brown)



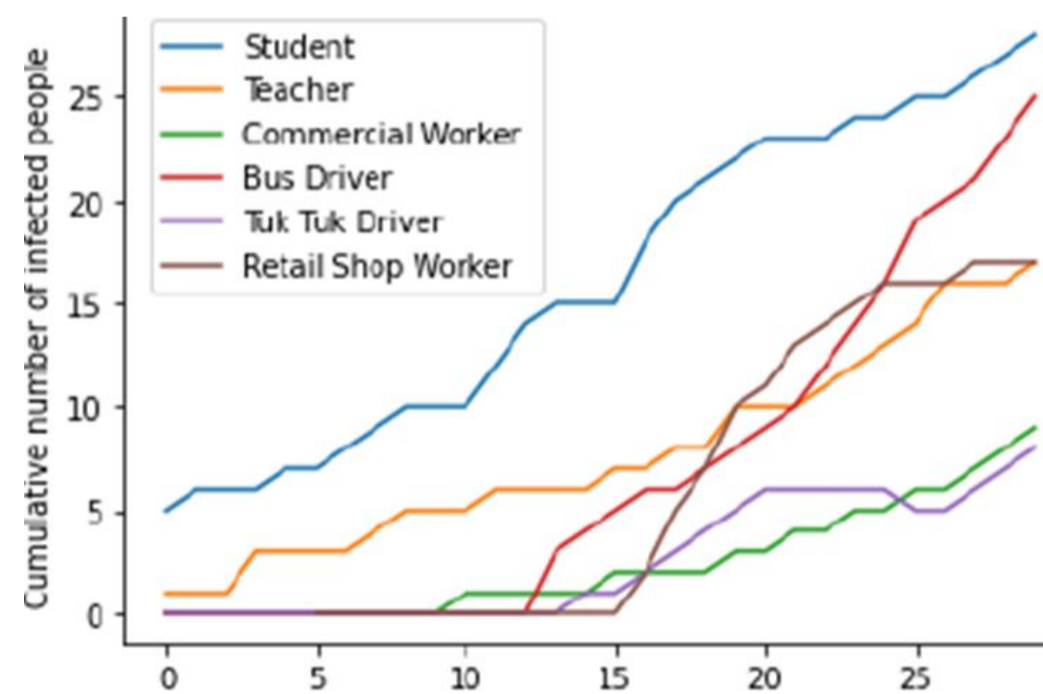
Location States of the Motion Distribution Models are linked to Location States identified in the real world environment

Simulate transportations routes to detect disease propagation

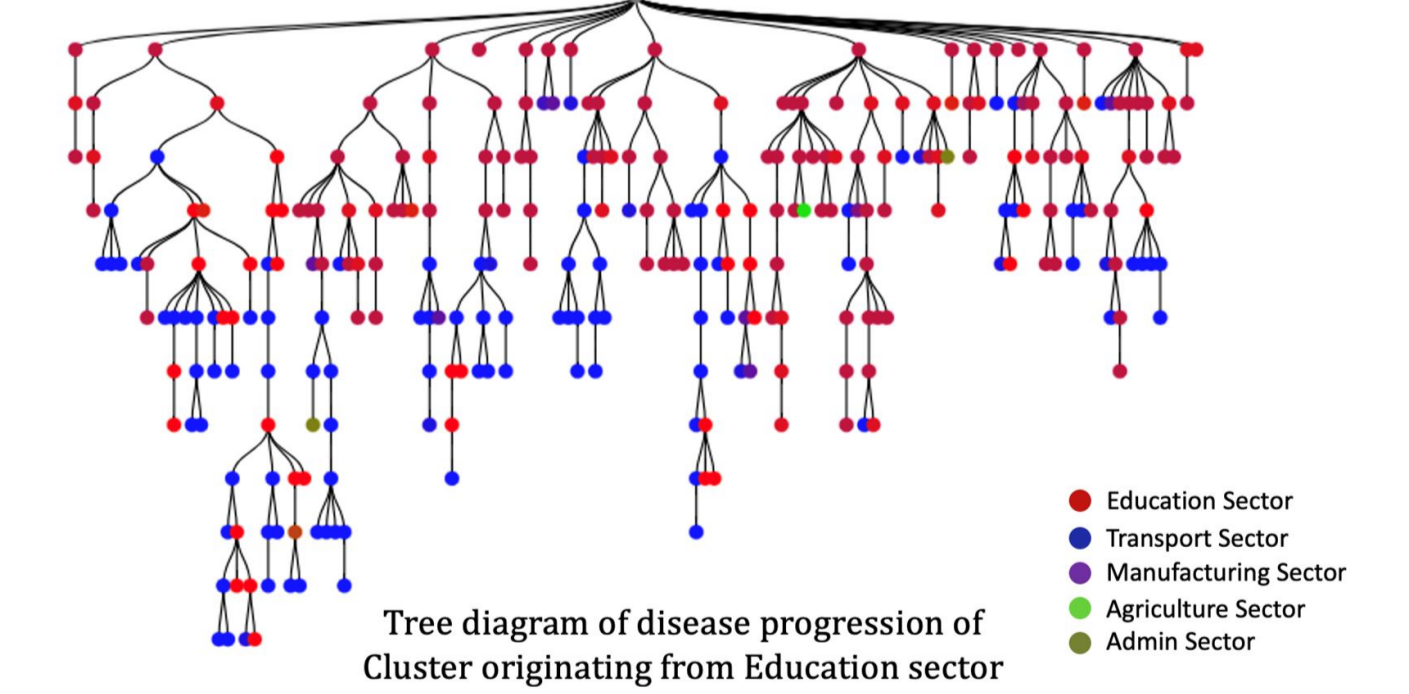
## Macro Level Insights

Insights of **disease propagation dynamics** in terms of occupation class interactions at the micro level

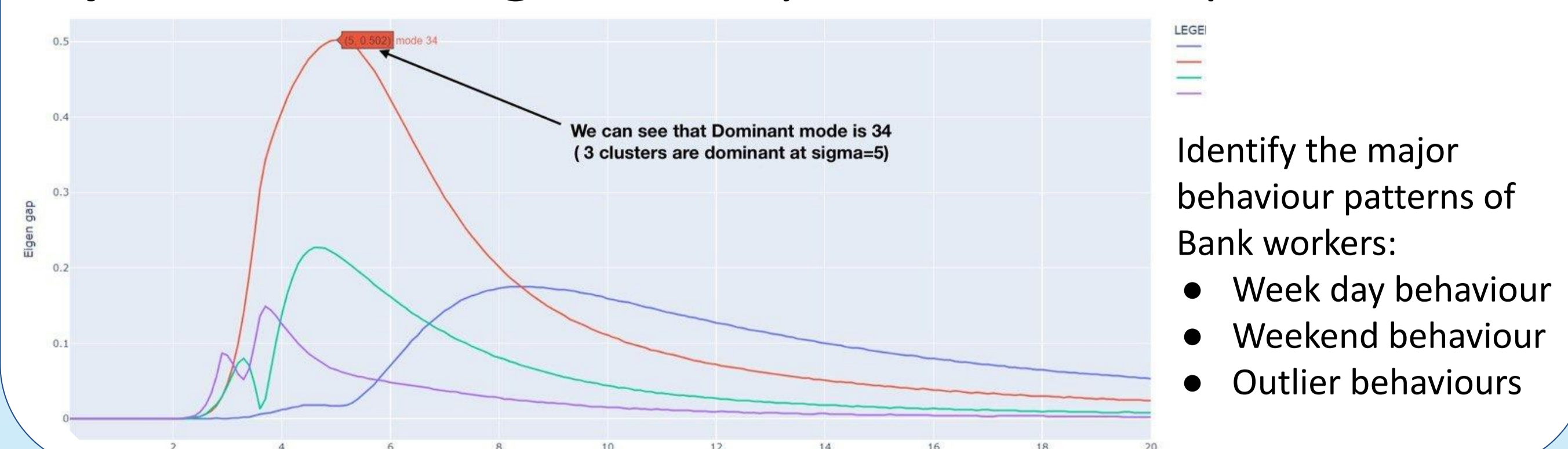
Number of Covid19 infected people based on their occupation over time



Covid19 disease propagation clustering originating from Education sector



**Spectral Clustering** to identify human motion patterns



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