University of Peradeniya

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

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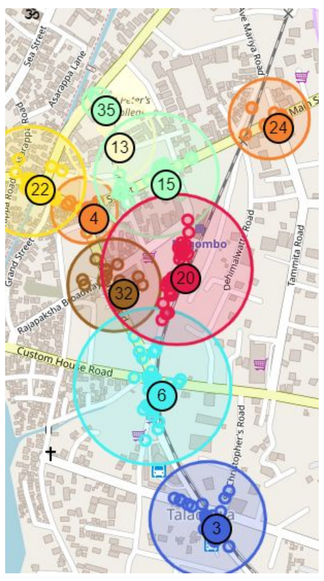
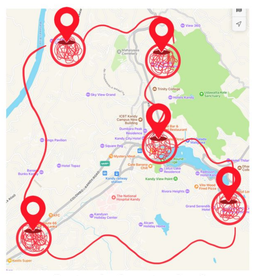
Pandemic Simulator: An Agent-Based Framework with Human Behavior Modeling for Pandemic-Impact Assessment to Build Sustainable Communities

by Harshana Weligampola [1], Lakshitha Ramanayake [2,*], Yasiru Ranasinghe [3], Gayanthi Ilangarathna [4], Neranjan Senarath [2], Bhagya Samarakoon [2], Roshan Godaliyadda [2], Vijitha Herath [2], Parakrama Ekanayake [2], Janaka Ekanayake [2], Muthucumaru Maheswaran [5], Sandya Theminimulle [6], Anuruddhika Rathnayake [7], Samath Dharmaratne [7], Mallika Pinnawala [8], Sakunthala Yatigammana [8] and Ganga Tilakaratne [9]

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.


(latitude, longitude, t)

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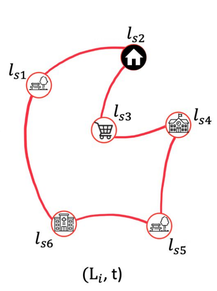
Domain Transformation



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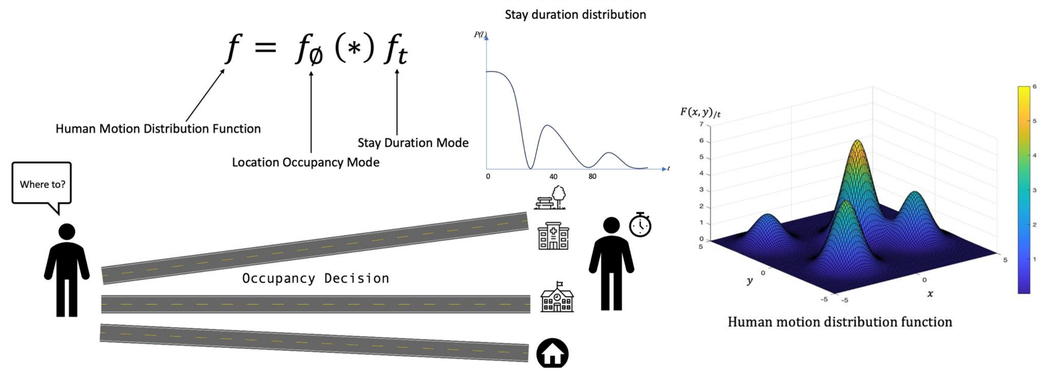
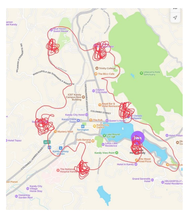
Motion Distribution Model

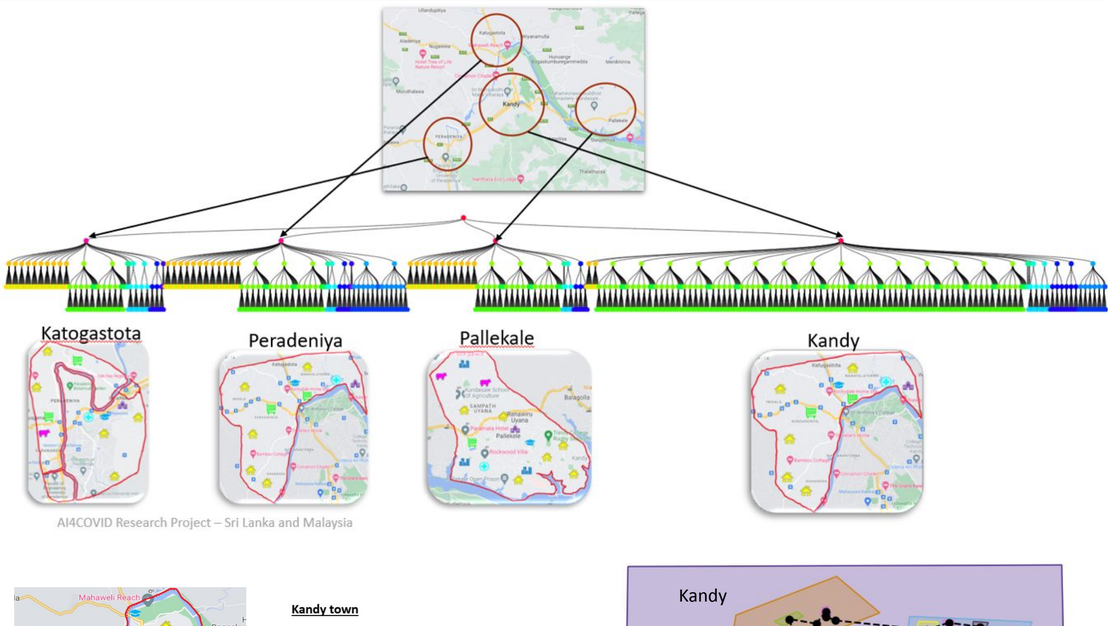


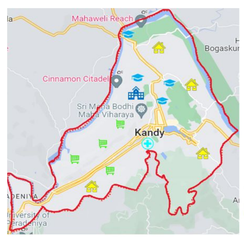
When at a specific location state: based on '**Stay Duration Mode**', time spent on random walk state are estimated.

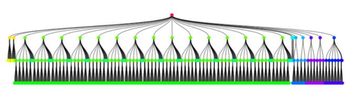
When stay duration expires: based on '**Location Visit Mode**', the decision on next Location state is generated.



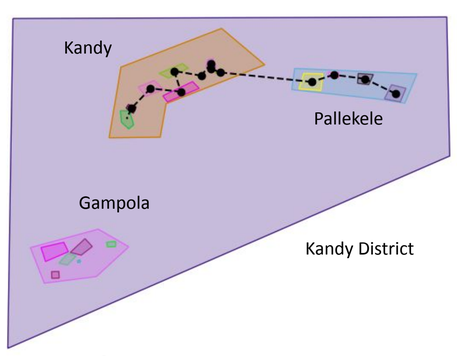
Environment Builder







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

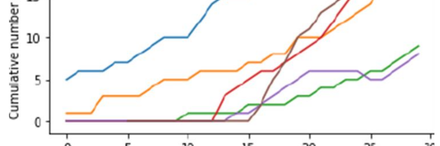


Simulate transportations routes to detect disease propagation

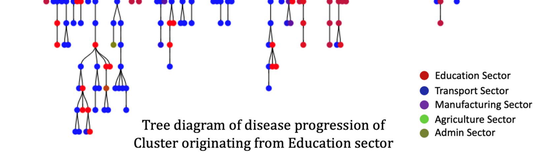
Macro Level Insights

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

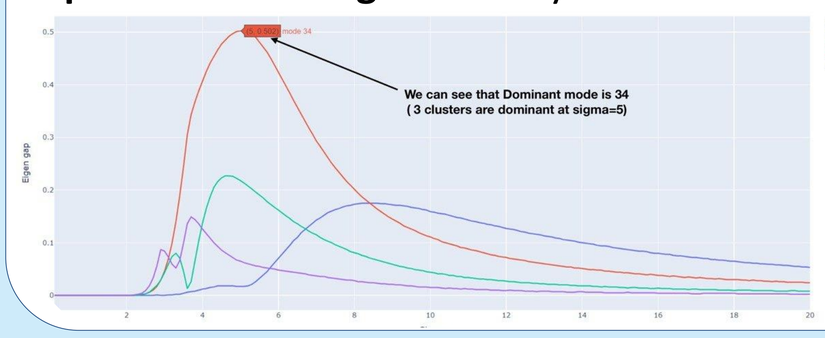


Covid19 disease propagation clustering originating from Education sector



Tree diagram of disease progression of Cluster originating from Education sector

Spectral Clustering to identify human motion patterns



Identify the major behaviour patterns of Bank workers:

- Week day behaviour
- Weekend behaviour
- Outlier behaviours

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