Shipment simulator V1.0

Documentation

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Revision History

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# Introduction

## Scope and objectives

The simulation of freight transport activities requires generation of shipments for each logistic firms. The firms can be generated by a firm synthesis procedure. The shipment simulator simulates different logistic choices of these firms. First, it synthesize shipments which generates a set of shipments that are transported in the study area. Then, these shipments are distributed and scheduled based on a sequence of logistic processes: producer selection; distribution channel choices; shipment size & vehicle type choice; and desired delivery time. Finally, the distributed shipments are assigned to vehicles’ tour through a bahavioural tour formation procedure. The tour formation procedure chooses the time for each tour based on the desired delivery times, and optimizes the sequence of trips in each tour.

# Requirements.

## Software requirements

The simulators have been built using Python version 3.8.8.

The following Python libraries need to be installed:

1. pandas==1.3.4
2. pyshp==2.1.3
3. tk==0.1.0
4. numpy==1.19.1
5. scipy==1.5.0
6. shapely==1.7.0
7. numba==0.53.0

## Input/Outputs

### Inputs

The inputs of the Shipment simulator are described in Table 1.

Table 1 Shipment Synthesis– Inputs

|  |  |
| --- | --- |
| Inputs | Description |
| skimTijd\_new\_REF.mtx | Distance skim matrix |
| skimAfstand\_new\_REF.mtx | logistics nodes |
| nodes\_v5.shp | study area |
| Zones\_v6.shp | Socioeconomic Data |
| SEGS2020.csv | Parcel depot nodes |
| parcelNodes\_v2.shp | Distribution centers |
| distributieCentra.csv | converion NSTR to Logistic segments |
| nstrToLogisticSegment.csv | Distribution of making shipments per logistic sectors |
| MakeDistribution.csv | Distribution of using shipments per logistic sectors |
| UseDistribution.csv | External Zones |
| MakeDistribution.csv | correction of tonnes |
| SupCoordinatesID.csv | Courier Market Shares |
| CorrectionsTonnes2016.csv | cost per vehicle types |
| CEPshares.csv | cost of out sourcing |
| Cost\_VehType\_2016.csv | NUTS32013 to MRDH conversion |
| Cost\_Sourcing\_2016.csv | carrying capacity |
| NUTS32013toMRDH.csv | market share of logistic flow types |
| CarryingCapacity.csv | parameters of time of day choice model |
| LogFlowtype\_Shares.csv | paraeters of shipment size and vehicle type choice model |
| Params\_TOD.csv | Parameters of end of tour choice model for the first visited location |
| Params\_ShipSize\_VehType.csv | Parameters of the end of tour choice model for the later visited locations |
| Params\_EndTourFirst.csv | consolidation potentials for different logistics sectors |
| Params\_EndTourLater.csv | specifications for the zero emmission zones in the study area |
| ConsolidationPotential.csv | synthesized firms specifications |
| ZEZscenario.csv | Distance skim matrix |
| Firms.csv | logistics nodes |

### Outputs

The outputs of the parcel generation module are described in Table 2.

Table 2 Parcel Generation– Outputs

|  |  |
| --- | --- |
| Outputs | Description |
| Shipments\_REF.csv | Shipments |
| Shipments\_REF.shp | Shapefile of shipments for visualization |
| zonal\_attractions\_REF.csv | Zonal freigfht trip attraction |
| zonal\_productions\_REF.csv | Zonal freight trip production |
| Logfile\_ShipmentSynthesizer.log | Logs of the run |

## Paths structure

The directory where the model is located has the following structure:

── Root

├── Input Folder

│

└── Output folder

# Model Description

This section describes the different files and scripts present in the model

|  |  |  |
| --- | --- | --- |
| File name | Location | Description |
| \_\_module\_SHIP\_\_.py | Root | Main script |
| \_\_functions\_\_.py | Root | External functions |
| requirements.txt | Root | Python packages required |
| Instruction.txt | Root | Instruction to run code from console |

# Instructions to run the model

## Command line execution of the model

### Instructions and commands

The instruction to install the packages needed:

* pip install -r requirements.txt

The instruction to run the model

python3 Parcel\_Generation.py Label Input Output Params\_ParcelGen.txt TimeSkimMatrix.mtx DistanceSkimMatrix.mtx StudyAreaShapefile.shp SocioeconomicData.csv ParcelNodes.shp CourierMarketShares.csv

### Arguments

The arguments in the instructions to run the model are:

Table 3 Parcel Generation– Inputs

|  |  |
| --- | --- |
| Arg[0] | Script name |
| Arg[1] | Lable(Name of the Scenario) |
| Arg[2] | Input folder name |
| Arg[3] | Output folder name |
| Arg[4] | Time skim matrx |
| Arg[5] | Distance skim matrix |
| Arg[6] | logistics nodes |
| Arg[7] | study area |
| Arg[8] | Socioeconomic Data |
| Arg[9] | Parcel depot nodes |
| Arg[10] | Distribution centers |
| Arg[11] | converion NSTR to Logistic segments |
| Arg[12] | Distribution of making shipments per logistic sectors |
| Arg[13] | Distribution of using shipments per logistic sectors |
| Arg[14] | External Zones |
| Arg[15] | correction of tonnes |
| Arg[16] | Courier Market Shares |
| Arg[17] | cost per vehicle types |
| Arg[18] | cost of out sourcing |
| Arg[19] | NUTS32013 to MRDH conversion |
| Arg[20] | carrying capacity |
| Arg[21] | market share of logistic flow types |
| Arg[22] | parameters of time of day choice model |
| Arg[23] | paraeters of shipment size and vehicle type choice model |
| Arg[24] | Parameters of end of tour choice model for the first visited location |
| Arg[25] | Parameters of the end of tour choice model for the later visited locations |
| Arg[26] | consolidation potentials for different logistics sectors |
| Arg[27] | specifications for the zero emmission zones in the study area |
| Arg[28] | synthesized firms specifications |

## Requirements

### Testing requirements

pip install -r requirements.txt

### Input folder (Arg[2])

Folder 1( e.g. Input)

Table 4 Parcel Generation– Inputs

|  |  |  |
| --- | --- | --- |
| Inputs | Type | Description |
| skimTijd\_new\_REF.mtx | mtx | Id of areas ordered increasingly |
| skimAfstand\_new\_REF.mtx | mtx | Id of areas ordered increasingly |
| nodes\_v5.shp | shp | Logistics node shapefile |
| Zones\_v6.shp | shp | Zones of the study area |
| SEGS2020.csv | csv | Required cols:  “zone”;  "1: woningen";  "9: arbeidspl\_totaal" |
| parcelNodes\_v2.shp | shp | Parcel depot nodes shapefile |
| distributieCentra.csv | csv | Distribution centers  "colnames": [{  "oppervlak":"float",  "WP": "int",  "Xcoor": "float",  "Ycoor": "float",  "AREANR": "int"  }] |
| nstrToLogisticSegment.csv | csv | converion NSTR to Logistic segments |
| MakeDistribution.csv | csv | Distribution of making shipments per logistic sectors |
| UseDistribution.csv | csv | Distribution of using shipments per logistic sectors |
| SupCoordinatesID.csv | csv | Required cols:  “COROP”;  " Xcoor ";  “Ycoor”;  " AREANR "; |
| CorrectionsTonnes2016.csv | csv | correction of tonnes |
| CEPshares.csv | csv | Required cols:  “CEP”;  "ShareTotal |
| Cost\_VehType\_2016.csv | csv | cost per vehicle types  "columns":[{  "CostPerKm":"float",  "CostPerH": "float"  }] |
| Cost\_Sourcing\_2016.csv | csv | cost of out sourcing  "columns":[{  "CostPerKm":"float",  "CostPerH": "float"  }] |
| NUTS32013toMRDH.csv | csv | NUTS32013 to MRDH conversion |
| CarryingCapacity.csv | csv | carrying capacity  "columns":[{  "Vehicle Type":"str",  "Tonnes": "float"  }] |
| LogFlowtype\_Shares.csv | csv | market share of logistic flow types |
| Params\_TOD.csv | csv | parameters of time of day choice model |
| Params\_ShipSize\_VehType.csv | csv | paraeters of shipment size and vehicle type choice model |
| Params\_EndTourFirst.csv | csv | Parameters of end of tour choice model for the first visited location |
| Params\_EndTourLater.csv | csv | Parameters of the end of tour choice model for the later visited locations |
| ConsolidationPotential.csv | csv | consolidation potentials for different logistics sectors |
| ZEZscenario.csv | csv | specifications for the zero emmission zones in the study area |
| Firms.csv | csv | synthesized firms specifications |