2024

Certificate Authority Cup International Mathematical Contest Modeling

http://mcm.tzmcm.cn

Problem C (ICM)
Iron Age Archaelogical Sites of Turkey

We possess a dataset pertaining to the Archaeological Settlements of Turkey. This dataset is the result of combining the data from the Archaeological Settlements of Turkey (TAY) Project with geo-spatial data sourced from OpenStreetMaps. It is derived from Kaan Eraslan's PhD project and is publicly accessible on the relevant website. For each archaeological settlement within this dataset, the following information is included:

1. The active dates;
2. Geo-spatial data indicating the town in which the settlement is located;
3. Information regarding the site type as well as its research status and methodology.

All of this information is contained within the file `taydata.json`. For the raw data, one can refer to `taydata.html`. The associated notebook for this dataset elucidates the process by which each file is generated.

Furthermore, the dataset encompasses several significant statistics related to the regions and cities of Turkey during the Iron Age. You need to analyse the structure of the dataset. Should one wish to visualize the data on a map, the `1200___330_bce_sites_of_turkey.umap` file can be utilized. This can be visualized on the platform `https://umap-project.org/`.

Tasks: We expect you to construct rational mathematical models to deduce the following information from this dataset:

1. The migration and expansion trajectories of the Iron Civilisation;
2. The most probable paths of material exchange and trade among different settlements within each distinct time period;
3. The locations where new settlements are most likely to be unearthed in hitherto undetected areas (this can be predicted for different time periods).

Notes:

1. Two code examples for data exploration are provided by Kaan Eraslan.

   https://www.kaggle.com/code/dkaane/turkey-choropleth-histogram-of-iron-age-sites

   https://www.kaggle.com/code/dkaane/data-extraction-protocol-for-iaasot

2. You can download the data from:
   https://pan.baidu.com/s/1YrdMRxmAB1ttPeQ6m2TD8Q?pwd=c2aw,
   the password is c2aw.