E-Waste Conversion Efficiency Tracking System for Landfill Creation to Optimize Resource Allocation for Recycling

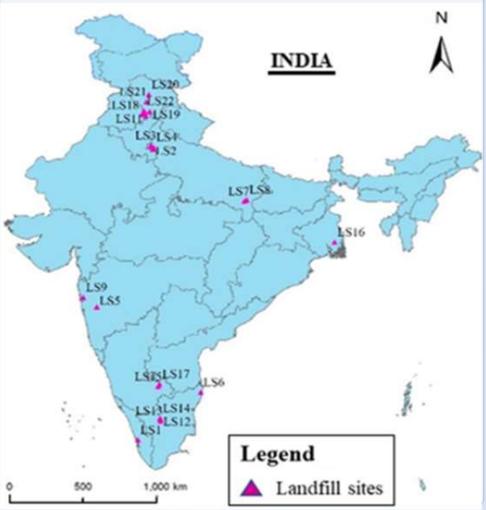
Anirudh Dash
Indian Institute of Technology, Hyderabad

INTRODUCTION

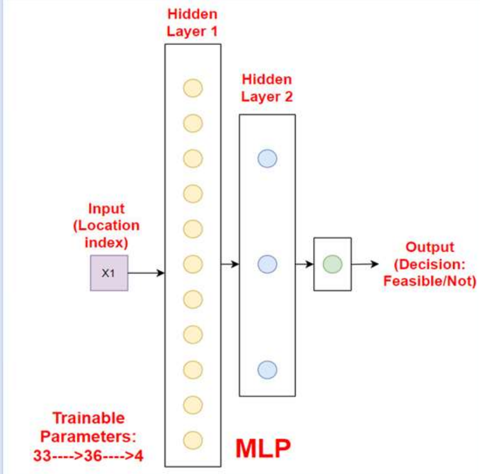
- ❑ The development of affordable electronic devices has considerably increased E-waste
- ❑ Mismanagement of E-Waste leads to land, water, and air pollution
- ❑ According to the UNEP, less than 20% of E-Waste is recycled formally
- ❑ Currently, not a viable industry from an economic stand-point
- ❑ Distribution of waste (and its content) varies based on geography, demographics, local economy

OBJECTIVES

- ❑ To determine how to channel resources optimally so that most of the E-Waste generated by a region can be recycled and reused
- ❑ To do so, we must prepare a model which can determine, given a new landfill, the revenue generated, and whether that justifies collecting and recycling E-Waste from it



MATERIALS AND METHODS



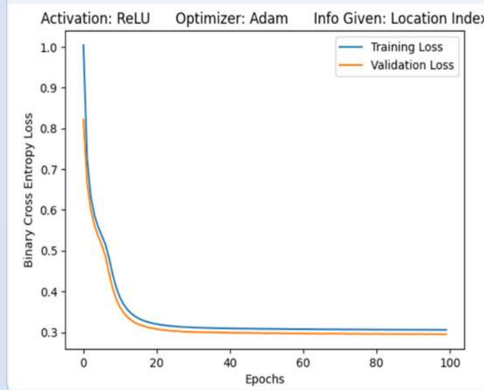
- ❑ We generate the dataset based on the locations of E-Waste Processing Plants and a combination of the following factors: Extraction cost, Transportation Cost, Revenue from plastic and metals, Revenue from precious metals, Revenue from Govt. Collaborations
- ❑ We develop an MLP model to predict whether a location is feasible for a new landfill
- ❑ We use 2 layers, the first for determining weights of coarse features such as costs and the second for determining finer features such as demographics and feasibility of the location
- ❑ We use a training-testing split of 80-20 and a validation split of 0.2
- ❑ We choose the optimizer which gives the best performance, even on a low number of epochs, along with the best corresponding activation function: This turns out to be **(Adam, ReLU)**

Optimizers Analyzed	Act. Funcs Analyzed
Adam	Sigmoid
AdaGrad	ReLU
Adamax	tanh
Adadelta	softmax
RMSProp	
Nadam	

All the above was for binary cross entropy loss- classifying whether a new landfill at a given location is feasible. We can also determine the mean squared error with respect to actual estimated revenue. Turns out, the same optimizer-activation combination gives the best performance

RESULTS

- ❑ If we provide the location index, along with the precious metal recovery cost and feasibility index:
  - ➢ The accuracy of prediction is 97.25%
  - ➢ The r2 score is 0.98
  - ➢ There is no overfitting of data
  - ➢ All of this is achieved within 10 epochs
  - ➢ Providing any more data on the cost parameters significantly improves all results



- ❑ If we provide just the location index:
  - ➢ The accuracy of prediction is 87.25%
  - ➢ The r2 score is 0.9
  - ➢ There is no overfitting of data
  - ➢ All of this is achieved within 100 epochs
- ❑ Efficiency index = Net revenue/ Cost Incurred (The solution is feasible if the index crosses a certain threshold)

CONCLUSIONS

- ❑ We have successfully created an MLP model which is able to predict, with reasonable accuracy, the feasibility of a location to be a landfill site
- ❑ There is some scope for improvement in terms of accuracy in the case of just providing the location and determining the feasibility of a location
- ❑ Finally, we can use an RNN to predict which regions will eventually need landfills based on the rate of population growth and access to technology

REFERENCES

- ❑ N.G. Resmi, K.A. Fasila: E-waste Management and Refurbishment Prediction (EMARP) Model for Refurbishment Industries
- ❑ Yinghao Chu, Chen Huang, Xiaodan Xie, Bohai Tan, Shyam Kamal, and Xiaogang Xiong: Multilayer Hybrid Deep-Learning Method for Waste Classification and Recycling
- ❑ M. U. Bukhari, A. Khan, K. Q. Maqbool, A. Arshad, K. Riaz, A.Bermak: Waste to Energy: Facile, Low-Cost and Environment-Friendly Triboelectric Nanogenerators Using Recycled Plastic and Electronic Wastes for Self-Powered Portable Electronics
- ❑ Wan-Dong Yang, Qing Sun, Hong-Gang Ni Cost-benefit analysis of metal recovery from e-waste: Implications for international policy
- ❑ Precious metals recovery from e-waste". Emew https://blog.emew.com/precious-metals-recoveryfrom-e-waste (accessed Dec. 12, 2023)

IEEE SusTech 2024