a.Executive summary

The aim of this project is to find out whether the average wind speed on Lamma Island is suitable for wind power development.

b.Description of the data and the question under investigation

This project would use the average wind speed data for Lamma Island to predict whether Lamma Island is efficient for wind power development. The data is provided by Hong Kong Observatory((https://data.gov.hk/en-data/dataset/hk-hko-rss-daily-mean-wind-speed/resource/568ae34c-dc0c-4052-9447-92f0da36c538)). The data contain the average wind speed of 1826 days from 2018 to 2022.However, some data is not available. Only 1824 days can be used.

To know that whether Lamma Island is efficient for wind power development, we can find out how long of the wind turbines can work for the whole time. The average wind speed should always be greater than 4 m/s (14.4 km/h) [1]. At very high wind speeds, that is gale force winds of 25 m/s, wind turbines shut down[2]. The average wind speed should always be less than 25 m/s (90km /h). In the UK, wind turbines are typically producing electricity 70-80% of the time, which makes them a reliable source of power throughout the year[3]. We would know the answer by comparing wind turbine operating hours.

c. List of methods that you have tried and their descriptive results

I use the decision tree to do it. First, I classify that the appropriate daily average wind speed as "Yes " and the

inappropriate daily average wind speed as"No". For average wind speed < 14.4 km/h, there are 1296 days. For average wind speed >= 14.4 km/h, there are 528 days. In the node (average wind speed >= 14.4 km/h) , there are 528 days <= 90 km/h and 50 days > 90 km/h.
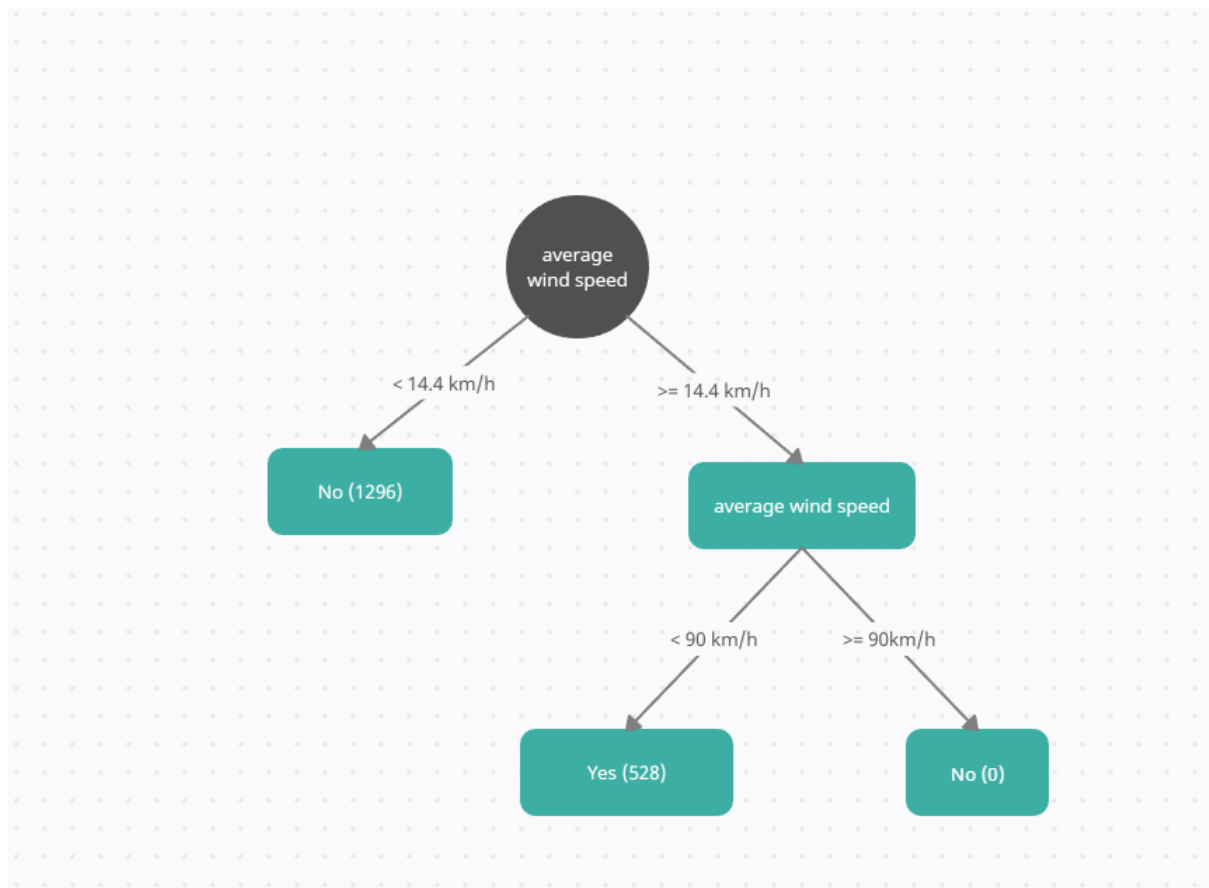
Based on this decision tree, I know that there are 528 suitable days to operate wind turbines in these 5 years (2018 to 2022). As a result, the wind turbines on Lamma Island are predicted to operate only 528/1824= 28.95% of the time in a year. Compared to the UK, they can operate 70-80% of the time in a year. There is a big difference(2 to 3 times). I believe this is not efficient for wind power development on Lamma Island because the average wind speed on the island of Lamma is not suitable for wind power development.

d. Describe the final solution package that you propose and their detailed results

the final solution is the decision tree. I only use one method because the decision tree show a real that the wind turbines on Lamma Island are predicted to operate only 528/1824= 28.95% of the time in a year. It is not efficient.
The detailed results are shown in the decision tree diagram and this excel daily_LAM_WSPD_ALL.xlsx .

e. Pros and cons of your proposed solution, potential improvements that you envision. If you continue with this project for your FYP, what will you do?

There are several advantages to using decision trees. First, a decision tree model is very intuitive and easy to show all the things. Decision tree makes no prior assumption on data and is fast and simple to implement (heuristics).

There are also some drawbacks to using decision trees. Decision tree is univariate splits limits types of possible learners (e.g. cannot learn simple linearly separable data sets) and large trees may be hard to understand, slow, and perform poorly. It is pruning / tuning can be tricky to get right and requires fixed length feature vectors.

If I continue with this project for your FYP, I will find the average wind speed of more places in Hong Kong. This will help me know more about whether Hong Kong is suitable for wind power development.

f.Societal impact: discuss how your project may benefit or harm the society.

My project may benefit the society by letting them know that the average wind speed on Lamma Island is not suitable for wind power development. They do not need to focus on developing wind power on Lamma Island.

f. Conclusions

This project found that the average wind speed on Lamma Island was not suitable for wind power development. By using the data of daily average wind speed for Lamma Island from 5 years (2018 to 2022), I created a decision tree diagram. It tells me that wind turbines on Lamma Island are only expected to operate only 28.95% of the time in a year. This is not enough to develop wind power. Although the average wind speed is only one dimension, it is the basic requirement for wind power development, and if it is not fulfilled, the development of wind power will not be successful.

g. A link to the github repository of the project

https://github.com/lsoull09/seem3650CourseProject

Reference

[1]   U.S. Energy Information Administration, "Where wind power is harnessed - U.S. Energy Information Administration (EIA)," *Eia.gov*, Mar. 30, 2022. https://www.eia.gov/energyexplained/wind/where-wind-power-is-harnessed.php

[2]   EWEA, "Wind Energy Frequently Asked Questions (FAQ)| EWEA," *Ewea.org*, 2016. https://www.ewea.org/wind-energy-basics/faq/

[3]   "All you need to know about wind power," *EDF*. https://www.edfenergy.com/energywise/all-you-need-to-know-about-wind-power