**ANL488 Project List for Jul 2022 Semester**

|  |  |  |
| --- | --- | --- |
| **No** | **Project Title** | **Description** |
| **18** | The reliability of Renewable Energy to replace oil and gas as our energy of choice  (Supervisor: Dr Munish Kumar) | Many renewable energy projects fall short of targets due to weather conditions differing from the forecast or suboptimal performances of the equipment. In 2019 & 2020, 15-20% of the wind and solar projects in India did not meet capacity utilisation targets largely because of wind generation curtailments and lower irradiance for solar projects. From a 2020 Fitch Ratings analysis, it is estimated 90% of wind farms failed to meet their mid-case production levels (P50), likely due to low predictability of wind itself. Wind farms are also estimated to experience 4% of loss in generation from the suboptimal performances of turbines. When not mitigated, the loss from suboptimal equipment performance could be significant: in China, a wind farm commissioned in 2018 only produced 37-45% of its installed potential and a study in revealed the turbine model selection, location of the farm and the turbine hub heights to play a huge part in the farm's losses.  Using techniques found in data mining, as well as machine learning and python programming, show how renewable energy production has increased over time, and then determine if it is delivering as expected. Using time series analysis and financial models, determine if the investments made in renewables will pay off over time.  Students who are strong/comfortable with Python programming and power BI/ Tableau, and interest in data science, analytics, finance and machine learning are preferred. Please email Dr. Munish Kumar ([munishkumar001@suss.edu.sg](mailto:munishkumar001@suss.edu.sg)) directly to express your interest in working on this project by noon 6 Jun 2022 and cc (leeyh@suss.edu.sg). |
| **19** | Evolution of Greenhouse Gas Production over time  (Supervisor: Dr Munish Kumar) | A lot of discussion has taken place at the various COP meetings held over the years; the elephant in the room has been and continues to be how the earth will continually warm and the greenhouse gas contribution for developed vs developing countries.  However, its also equally important to understand which industries are contributing. The goal of this project is to evaluate the   1. 5 highest greenhouse producing countries, 2. 5 lowest greenhouse producing countries, 3. the top 5 industries in each county that contribute to this and 4. predict how the greenhouse gas emission will change over time, based on the evolution of those industries over a 50 year window?   Students who are strong/comfortable with Python programming and power BI/ Tableau, and interest in data science, analytics and machine learning are preferred. Please email Dr. Munish Kumar ([munishkumar001@suss.edu.sg](mailto:munishkumar001@suss.edu.sg)) directly to express your interest in working on this project by noon 6 Jun 2022 and cc ([leeyh@suss.edu.sg](mailto:leeyh@suss.edu.sg)). |
| **20** | Renewable energy generation and dependency in Singapore  (Supervisor: Dr Munish Kumar) | Singapore is embarking on a journey to “green up” her sources of energy. In 2021, a team at NTU proposed a study on geothermal energy in Singapore (<https://www.ntu.edu.sg/news/detail/study-on-geothermal-energy-potential-for-singapore>). However, this is not the only type of renewable energy around. Through bodies like the PUB and the EMA, Singapore has massively “Solarized” our grid (<https://www.straitstimes.com/singapore/singapores-first-large-scale-solar-floating-farm-opens-at-tengeh-reservoir>). The question becomes – is this enough, to offset our growing demands for energy consumption?  Using techniques found in data mining, as well as machine learning and python programming, document (a) Singapore’s energy journey with respect to time, over the past 20 years and then (b) predict, based on trends related to energy consumption and population growth, how much of our power will need to continue to come from non-renewable sources up to 2050.  This project will require you to perform a time-series analysis and extract data from https://data.gov.sg or https://www.singstat.gov.sg/ or other such sites to address the question.  Students who are strong/comfortable with Python programming and power BI/ Tableau, and interest in data science, analytics, energy, environment and machine learning are preferred. You will need to do some financial modelling, so Please email Dr. Munish Kumar ([munishkumar001@suss.edu.sg](mailto:munishkumar001@suss.edu.sg)) directly to express your interest in working on this project by noon 6 Jun 2022 and cc (leeyh@suss.edu.sg). |
| **21** | Using Data Science to Analyze Solar Power in Singapore  (Supervisor: Dr Munish Kumar) | Singapore has invested heavily in solar, to offset our carbon emissions and reduce our reliance on fuel imports, so as to meet the energy needs of the country. However, solar by itself is not 100% reliable. Your task in this study is to determine (a) some causes of why solar output is less than expected, (b) estimate the output during over a 1 year window and (c) forecast the output for the next 2 months after.  Students who are strong/comfortable with Python programming and power BI/ Tableau, and interest in data science, analytics, energy, environment and machine learning are preferred. Please email Dr. Munish Kumar ([munishkumar001@suss.edu.sg](mailto:munishkumar001@suss.edu.sg)) directly to express your interest in working on this project by noon 6 Jun 2022 and cc ([leeyh@suss.edu.sg](mailto:leeyh@suss.edu.sg)). |
| **22** | Pressure Prediction for oil and gas drilling and monitoring  (Supervisor: Dr Munish Kumar) | Pressure management, monitoring and maintenance is one of the most important oil field properties. As oil and gas is produced from the ground, the natural pressure present in the reservoir is reduced and thus different methods of maintaining the pressure have to be devised. To know the optimal point of intervention requires one to monitor the pressure, and the monitoring is often via underground pressure gauges, where readings taken at set points in time. In this way, a “time-lapse” of the pressure depletion is determined. However, there are older, legacy wells where it is not possible to install these costly gauges, for a variety of reasons. The wells might not be designed to take these tools, or for reasons of safety and cost, it makes no sense to install new equipment. The only readings in these older wells are in fact those you find on the surface  Using methods of machine learning and AI, develop an algorithm where surface measurements can be used to predict the underground pressure value. You will be provided with a data set of publicly available data; you will be required to build an analytical (predictive) model using conventional machine learning algorithms (e.g. decision trees), as well as a model using an artificial neural net (ANN). You will than be asked to perform a comparison and explain which of the 2 models you think is better, and why.  Students who are strong/comfortable with Python programming and power BI/ Tableau, and interest in data science, analytics, energy and machine learning are preferred. Please email Dr. Munish Kumar ([munishkumar001@suss.edu.sg](mailto:munishkumar001@suss.edu.sg)) directly to express your interest in working on this project by noon 6 Jun 2022 and cc ([leeyh@suss.edu.sg](mailto:leeyh@suss.edu.sg)). |
| **23** | Predicting the Rock Type for Mining, Oil and Gas | Oil and gas is typically produced from sedimentary basins which can either be sandstone or carbonates. To produced oil and gas, one must first drill a well, and extract rock samples to determine its storage and flow capacity.Engineers refer to the flow capacity as “permeability” and storage capacity as “porosity”. Traditionally, these 2 terms were used to classify the oil/gas reservoir rock into “rock types”. An oil and gas well may have multiple rock types. In a reservoir model, these rock types are then used to predict away from areas that have been drilled, the goal being to target/drill in locations with the most “optimal” rock type. Unfortunately, just depending on these 2 terms can be problematic as nature is often non-linear. Other important parameters include geographic location as well as geological age of the rock, temperature, pressure, grain density, depth etc. Some geoscientists have thus developed different methods of rock typing, which can be based on relationships to these different terms. Using methods of machine learning and AI, develop classification algorithms to classify rock measurements into unique rock types. You will be provided with data set(s) of publicly available data from different regions around the world; you will be required to build a database (SQL, Tabluea, Power BI) which is accessible for use with analytical (predictive) models with at least 2 different clustering methods using machine learning algorithms. You will then be asked to perform a comparison and explain which of the 2 models you think is better, and why.  Students who are strong/comfortable with SQL, Python programming and power BI/ Tableau, and interest in data science, analytics, energy and machine learning are preferred. Please email Dr. Munish Kumar ([munishkumar001@suss.edu.sg](mailto:munishkumar001@suss.edu.sg)) directly to express your interest in working on this project by noon 6 Jun 2022 and cc ([leeyh@suss.edu.sg](mailto:leeyh@suss.edu.sg)). |

Updated on 30 May 2022