COMPOSIT
IIT KHARAGPUR

EDENWENZ

presents

EXCAVATE

ROUND 1

PROBLEM STATEMENT

BACKGROUND:

More than a century ago, in 1911, Dutch physicist Heike Kamerlingh Onnes, observed that the electrical resistance of mercury suddenly dropped to zero when it was cooled to below 4.2 Kelvin (-268.8°C). This marked the first time a material had ever been seen to show this behaviour and this opened the door to decades of research and investigation into this fascinating phenomenon.

Today this phenomenon, aptly known as 'Superconductivity' has become an important area of research with its applications in several next generation technologies. Engineers have used superconductivity in magnets to make ultra-strong magnets needed in MRI machines. They have used them to make 'flying' trains that can travel at high speeds without friction (MAGLEV). Superconducting circuits allow for faster computer performance and form a core part in realising quantum computers. It also has the potential to allow for very efficient high voltage long distance power transmission and much more.
The application of superconductive technology is infinite given we can figure out how to make it cost effective and feasible at higher temperatures.

CONTEXT:

Given is a data set shared by a renowned material science laboratory, recording data of 21,263 superconductors with 82 features. This data has already been pre-processed although further processing may be done as suitable to the participants.

Superconducting materials are characterised by their ability to conduct electricity with zero resistance at low temperatures. The critical temperature (Tc) is the temperature at which a material transitions from a non-superconducting state to a superconducting state. There are many chemical and structural parameters that can affect Tc, including the chemical composition, crystal structure, lattice constant, atomic radius, electronegativity, and more. Understanding the relationship between chemical and structural parameters of superconductors and their critical temperature (Tc) is crucial for the development of new and improved superconducting materials with higher Tc values. However, this remains poorly understood.

REPORT:

Carry out an analysis, using the dataset provided, and investigate the impact of the chemical and structural parameters of a variety of superconducting materials, on their corresponding Tc values. Identify the most important parameters affecting Tc and develop a predictive model that can accurately predict Tc based on these parameters.

Your report must include:

- A representation of the proposed relationship of important features
- A link to your code
- R-squared error value of the model proposed

Note: If you report the accuracy, you must also mention the training: test set ratio used.

Link to the dataset:

https://drive.google.com/file/d/1CY6oePmJY_ZuwNowbhE4Ojvq3PH6UWXf/view?usp=sharing

Rules and regulations:

https://drive.google.com/file/d/1kqDIad3xbW4toWG911TsBtKr0UnAYXXA/view

Round 1 Submission Link (Submission Deadline - 1st April, 8 pm IST):

https://forms.gle/b6RryzNaSqSQN57G9