Program 1 : EV battery balancing:

These visualizations—the confusion matrix heatmap and the Receiver Operating Characteristic (ROC) curve—provide insights into the performance of a predictive model used for determining the need for balancing in battery cells based on various parameters like cell voltage, temperature, charge and discharge currents, state of charge, and health.

The confusion matrix visualizes the accuracy of predictions, distinguishing between correct and incorrect classifications for both classes ("No Balancing" and "Need Balancing"). It's essential for understanding the model's performance in specific scenarios.

The ROC curve, along with the area under the curve (AUC), assesses the model's ability to discriminate between the two classes across different thresholds. A higher AUC value indicates better model performance, with a value of 1 representing perfect prediction and a value of 0.5 indicating no discriminative power.

Together, these tools are crucial for evaluating the trade-offs between true positive rates and false positive rates, helping to refine the model for more accurate and reliable predictions in battery cell balancing applications.

Active balancing: model dataset

ID	Cell Voltage (V)	Cell Temperature (°C)	Charge Current (A)	Discharge Current (A)	State of Charge (%)	State of Health (%)	Need for Balancing
0	3.62	24.17	6.18	3.20	31.15	90.09	0
1	3.73	29.61	5.98	5.05	22.60	85.88	1
2	3.79	20.97	4.43	3.22	32.99	81.11	1
3	3.74	34.09	4.02	5.37	37.81	86.29	1
4	3.80	29.13	4.01	2.98	75.26	92.25	0
5	3.69	32.59	5.17	3.80	25.22	84.92	1