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Transición energética en la 4ta revolución industrial



Universidad
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SARFI-X Estimation in Unbalanced Distribution Systems based on Synchronized Voltage Bus Measurements and Linear Support Vector Machines

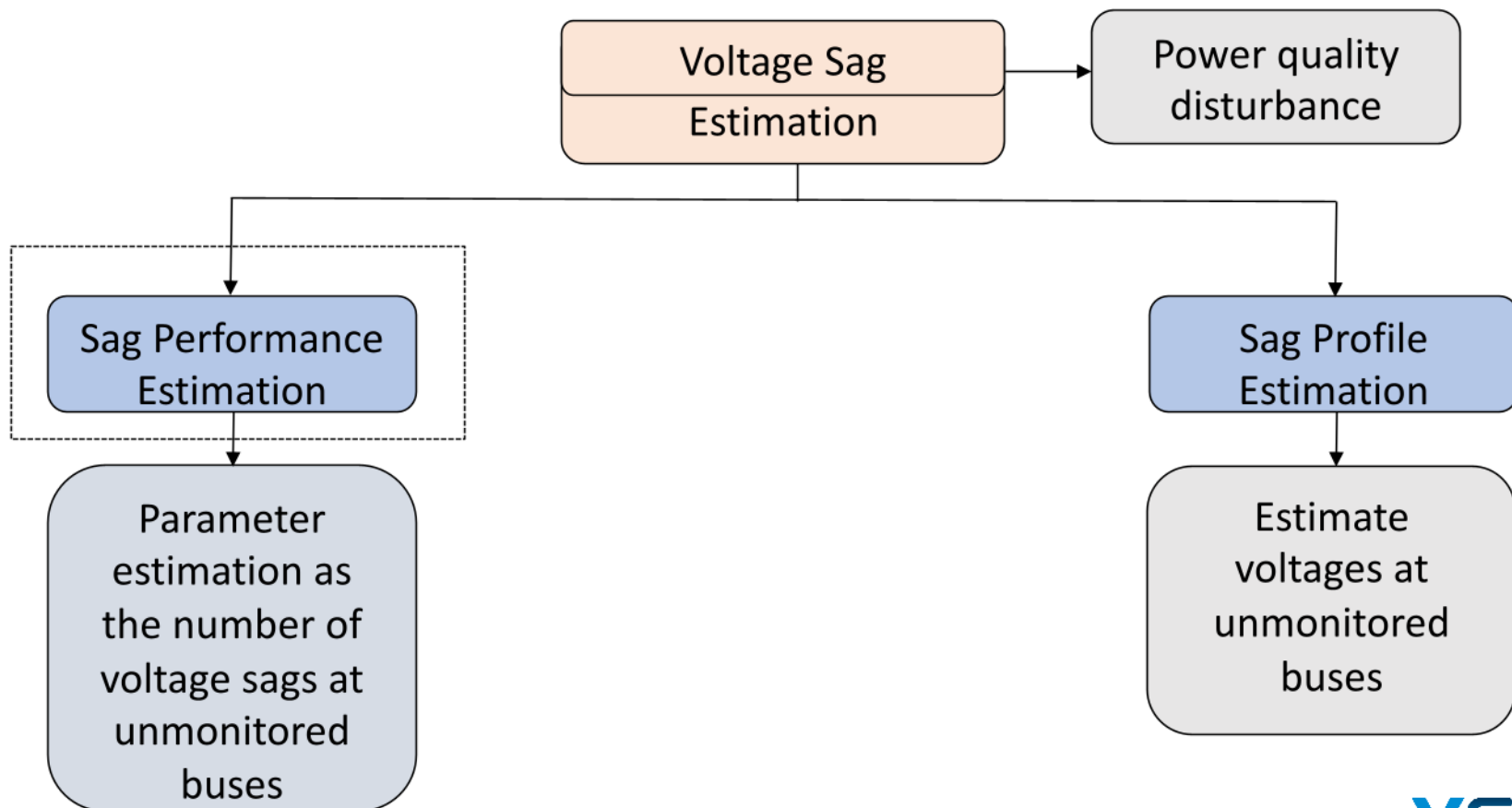
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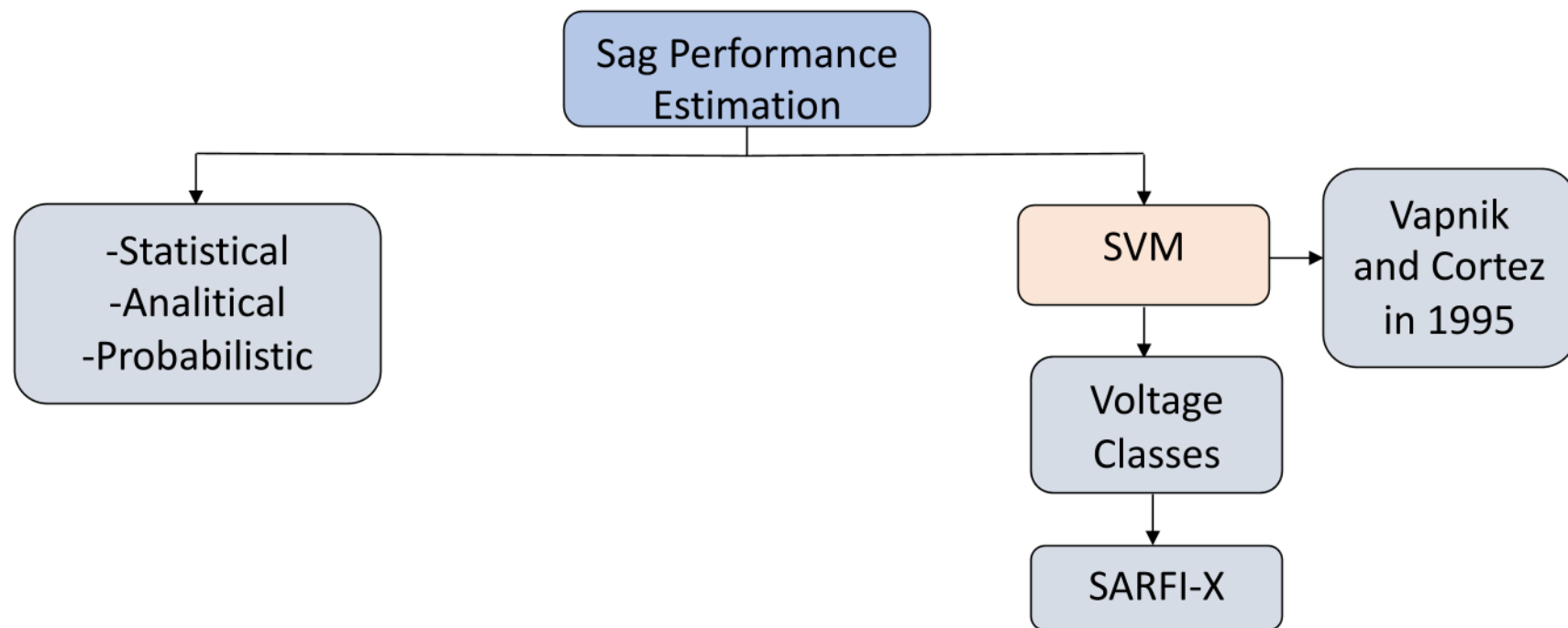
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I. Introduction

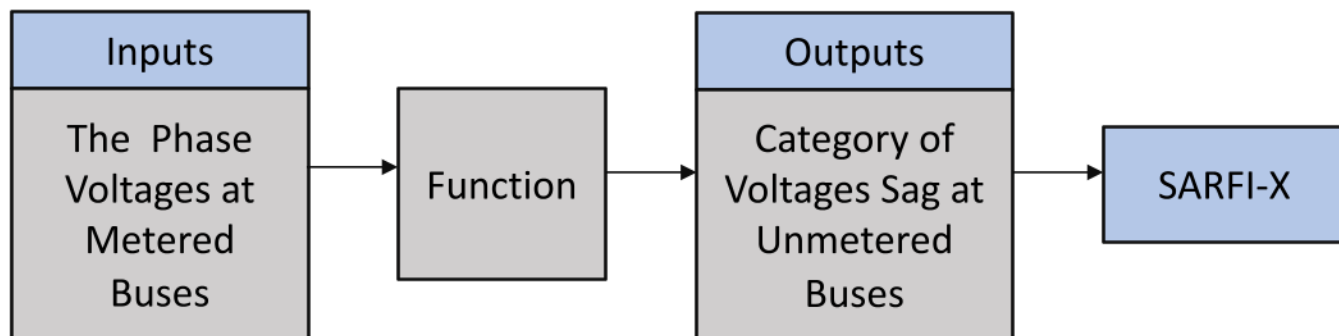


I. Introduction

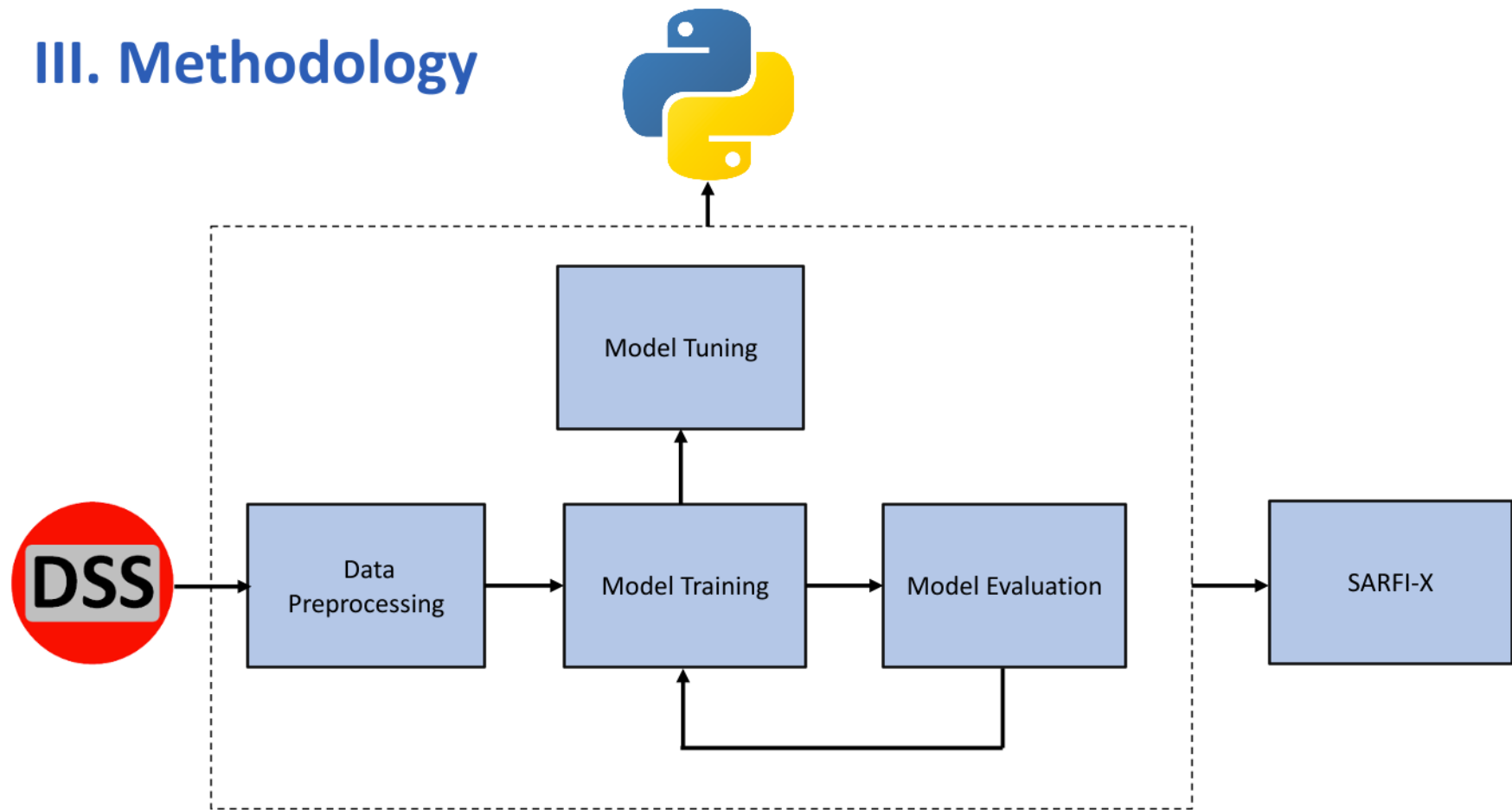


II. Problem Formulation

The problem to be solved consists in classifying the magnitude of voltage sags at unmonitored buses into six possible categories.

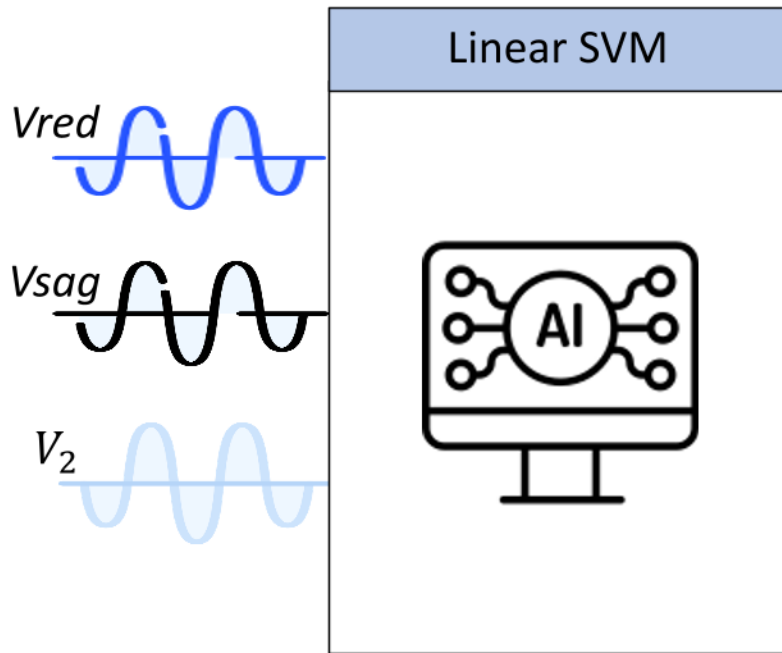


III. Methodology



III. Methodology

III.2 Input features

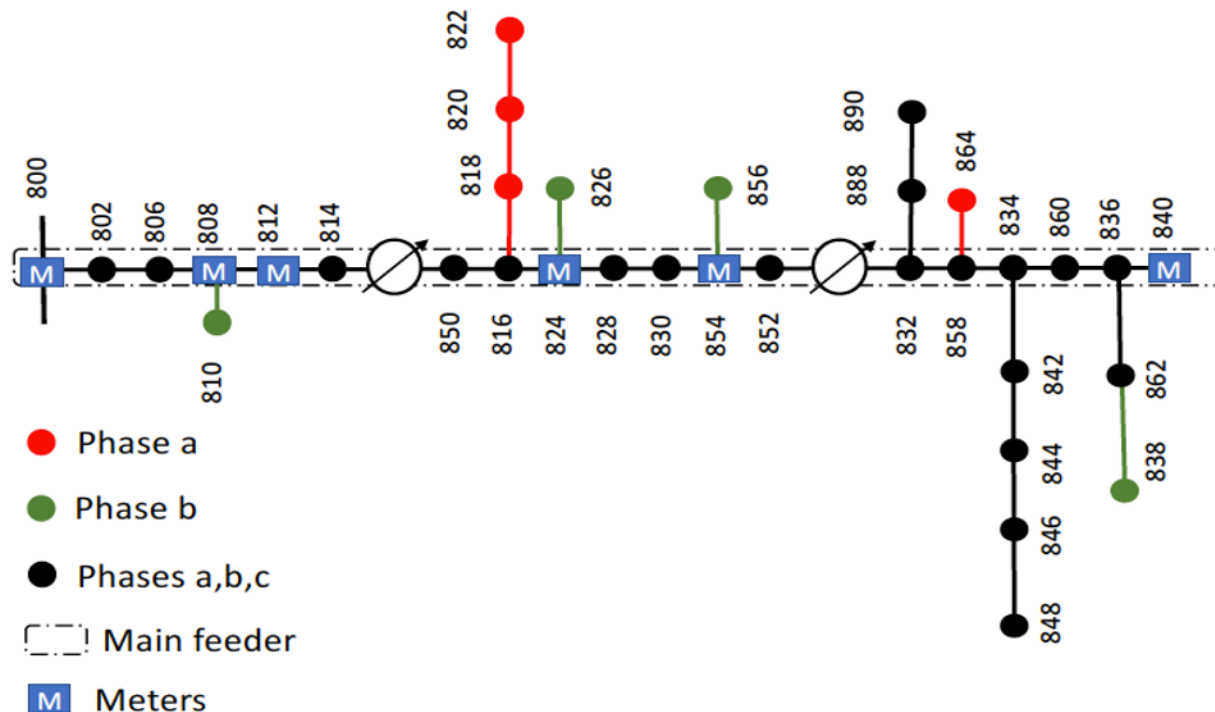


These features demonstrates good performance in [5].

[5] Huilian Liao, Jovica V Milanović, Marcos Rodrigues, and Alex Shenfield. "Voltage sag estimation in sparsely monitored power systems based on deep learning and system area mapping". IEEE transactions on power delivery, 33(6):3162–3172, 2018.

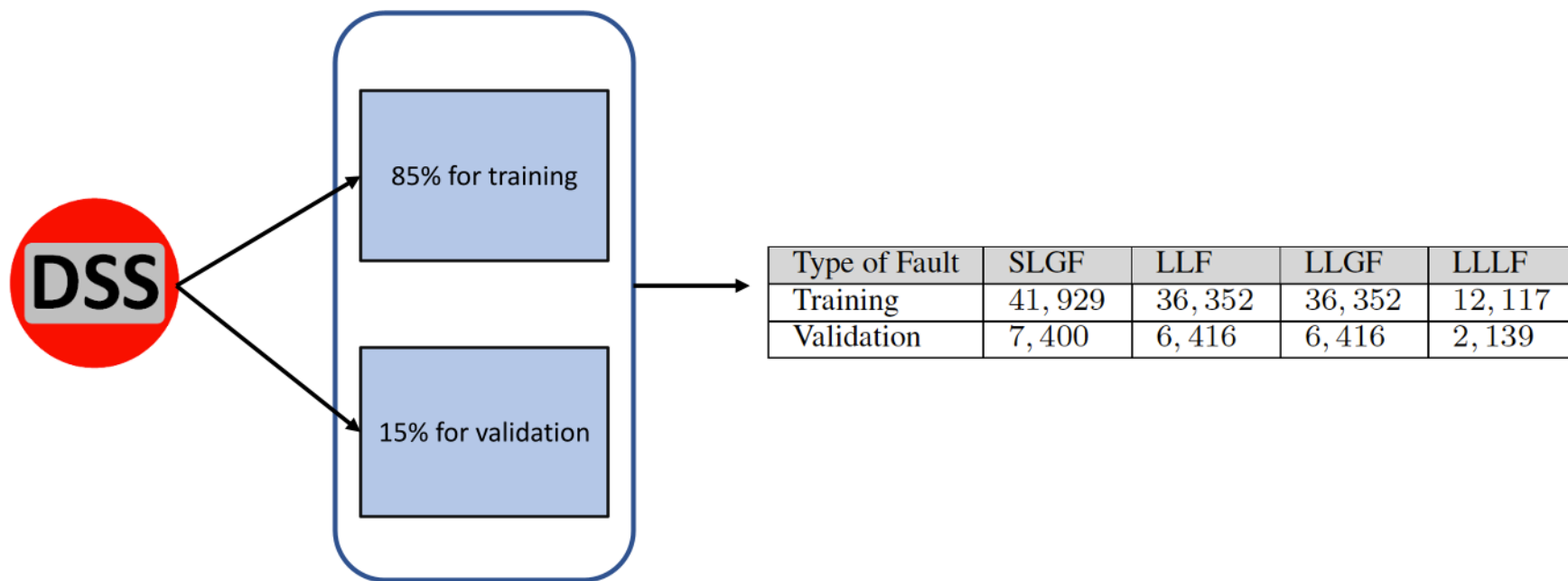
IV. Study case

IV.1 IEEE-24 bus



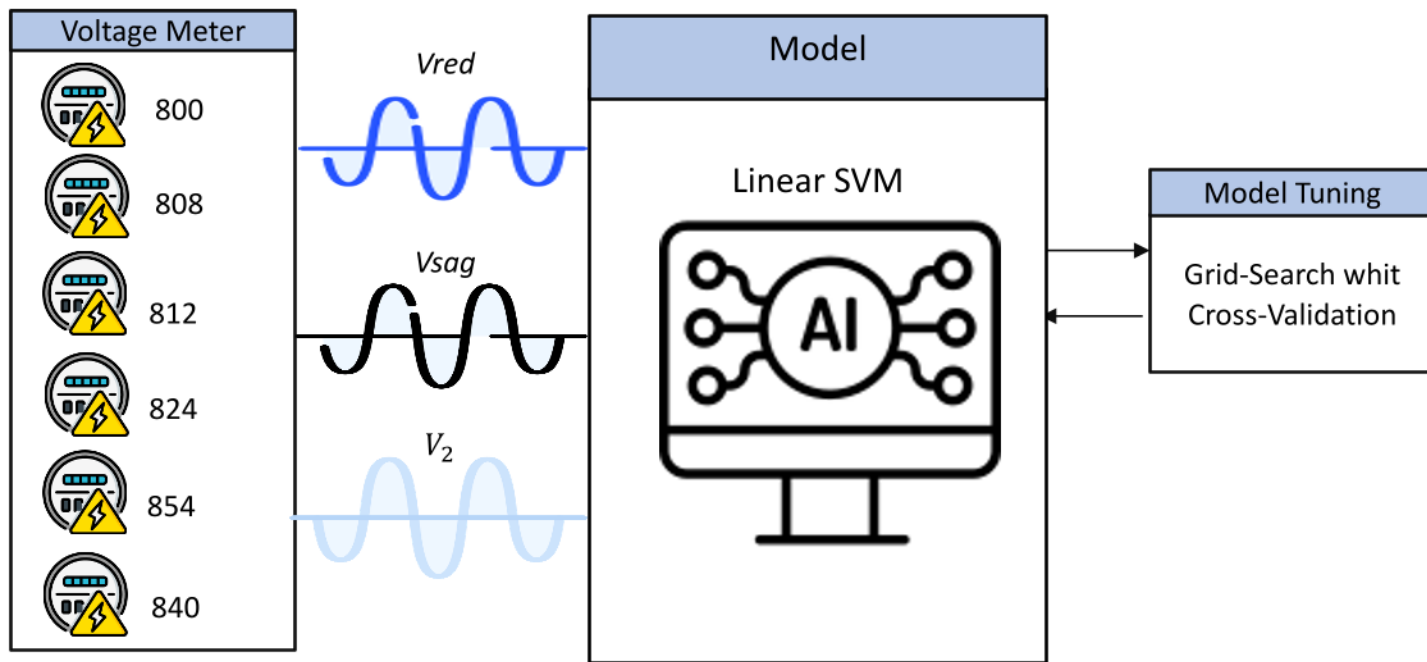
IV. Study case

IV.1 Training and validation data



IV. Study case

IV.2 Linear SVM training process



IV. Study case

IV.3 Linear SVM performance accuracy

- Global accuracy:
$$Accuracy_g(\%) = \frac{1}{n} \sum_{i=1}^n Accuracy_i$$
- Individual accuracy :
$$Accuracy_i(\%) = \frac{\text{correct predictions}}{\text{total predictions}} \times 100$$

Results

Type of Fault	SLGF	LLF	LLGF	LLLF
$Accuracy_g(\%)$	93.42	74.82	90.54	94.78
Maximum(%)	98.59	90.16	95.18	97.33
Minimum(%)	77.26	68.47	66.23	86.95

IV. Study case

IV.4 Sarfi-X index

In this study SARFI-80 and SARFI-90 are computed in the unmonitored buses and their error percentage is estimated as:

$$E_{SARFI(\%)} = \frac{|SARFI_{act} - SARFI_{est}|}{SARFI_{act}} \times 100.$$

IV. Study case

Percentages of error SARFI-90

Type of Fault	SLGF	LLF	LLGF	LLLF	TOTAL
SARFI-90 _{act}	163,990	116,554	124,217	41,276	446,037
SARFI-90 _{est}	163,910	116,241	123,976	41,265	445,392
Deviation	80	313	241	11	645
Error(%)	0.05	0.27	0.19	0.03	0.14

IV. Study case

Percentages of error SARFI-80

Type of Fault	SLGF	LLF	LLGF	LLLF	TOTAL
SARFI-80 _{act}	154,575	105,987	118,912	39,208	418,682
SARFI-80 _{est}	153,768	106,440	118,973	39,139	418,320
Deviation	807	453	61	69	1390
Error(%)	0.52	0.43	0.05	0.18	0.33

IV. Conclusions

1. The results demonstrate that different magnitudes of voltage sags can be classified, obtaining a global accuracy ranging from 74.82% for line to line faults to 94.78% for three phase faults.
2. The SARFI-90 and SARFI-80 indexes are estimated whit a maximum error of 0.27% for line to line ground faults and 0.52% for single line to ground faults, respectively.
3. The case study exhibits a total error of 0.14% for SARFI-90 and 0.33% for SARFI-80 .

Thank you

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Questions?