# Deep Learning Models for FDI detection on IEEE-118 Bus System

## Comparison Accuracy and Computational Factors of all Models

Chart, bar chart

Description automatically generated

## Detailed Stats

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model/**  **Metric** | **Attention-Based Bisectional LSTM** | **CNN** | **LSTM** | **MLP** |
| F1 Score | 0.991 | 0.996 | 0.877 | 0.994 |
| **Number of Parameters** | **8429160** | **4059188** | **90292** | **4164148** |
| Number of Units in a layer | 128 | 128 | 128 | 128 |
| **Row Accuracy** | **69.8%** | **80.4%** | **9.3%** | **73.7%** |
| Test Accuracy | 99.7% | 99.9% | 96.0% | 99.8% |
| **Time Taken (s)** | **3451** | **746** | **1411** | **579** |
| Training Accuracy | 99.8% | 100.0% | 95.2% | 99.9% |
| Validation Accuracy | 99.7% | 99.8% | 96.0% | 99.8% |

## Learning Curves

|  |  |  |  |
| --- | --- | --- | --- |
| **CNN** |  | **MLP** |  |
| **LSTM** |  | **ATTENTION BASED BIDIRECTIONAL LSTM** |  |

## Baseline models Implementations

Row accuracy is only 9% for SVM and 10% for Linear Regression. Hence traditional models are not useful.

## Theme and Future Work

Further work:

-Training on rest of the four variants of dataset (which vary with respect to level of noise).

**-Resource Vs. Performance tradeoff analysis** i.e., evaluate different architectures of each model. For example:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Architecture | Number of Layers | Neurons in Each Layer | Test Row Accuracy | Test Accuracy | Time Taken |
| CNN | 2 | 128 | x | … | … |
| 64 | xx |  |  |
| 3 | 128 | x |  |  |
| 64 | xx |  |  |
| Attention-Based | 2 | 128 | x |  |  |
|  | 64 | xx |  |  |
| 3 | 128 | x |  |  |
|  | 64 | xx |  |  |
| .  .  . |  |  |  |  |  |

-[Experimental] Critical Nodes weightage (for scenario with limited resource for training).

-Data Generation

**-Experiments on IEEE-14**

**-Paper Skeleton**

**-LSTM+CNN hybrid model.**

Theme of Paper:

* Quantify the tradeoff between computational requirements and performance of different Deep Learning (DL) algorithms for FDI attacks detection -- at the granularity of each node in the smart grid.
* Identify robust DL models and their architectures which can detect attack at every single node in smart grid (using row accuracy).
* Compare performance with traditional (non-deep learning based) models.

## Gantt Chart

Timeline

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