Deep Learning Model: Flavour

Classification Results

- Overall Accuracy : 77% (BDT) → **81%.**
- The most significant improvement: ν_e CC:
  - Precision: 0.76%→ 0.89%, Recall: 0.60% → 0.84%.
  - **Why?** *Pre-Train* learns generalizable representation of what a physically EM shower.
- **First Identification of Tau Neutrinos:**
  - Promising first step: **11 true ν_τ CC events correctly identified** *(BDT had 0% Precision).*
  - **Why?** *Pre-Train* created a feature space where rare events could became *separable* from other classes.

Class	Precision	Recall
ν_e CC	0.89	0.84
ν_μ CC	0.82	0.94
ν_τ CC	**0.79**	**0.00**
NC	0.73	0.58

Pred.	True ν_e	True ν_μ	True ν_τ	True NC
ν_e	**13,395**	789	103	726
ν_μ	1,864	**72,208**	1,705	12,748
ν_τ	0	0	**11**	3
NC	603	3,537	2,596	**18,403**

Deep Learning Model: Visible Energy

Regression Results

- **`E_vis`**: magnitude of `visible_momentum`
  - For CC it corresponds to Incoming Neutrino Energy.
  - For NC it corresponds to Hadrons Energy.
- Remarkable improvement in energy reconstruction:
  - Eliminated bias for ν_e CC.
  - The resolution is almost *halved* for all classes.