Energy Consumption Modelling with Hybrid Feature Selection Aided Attention Mechanism

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Background

- High energy efficiency of the 5G network
  - Only with robust and scalable energy management
- Base station parameters, energy-saving modes $\rightarrow$ energy consumption
- Cross-equipment and cross-configuration generalization ability

System Model

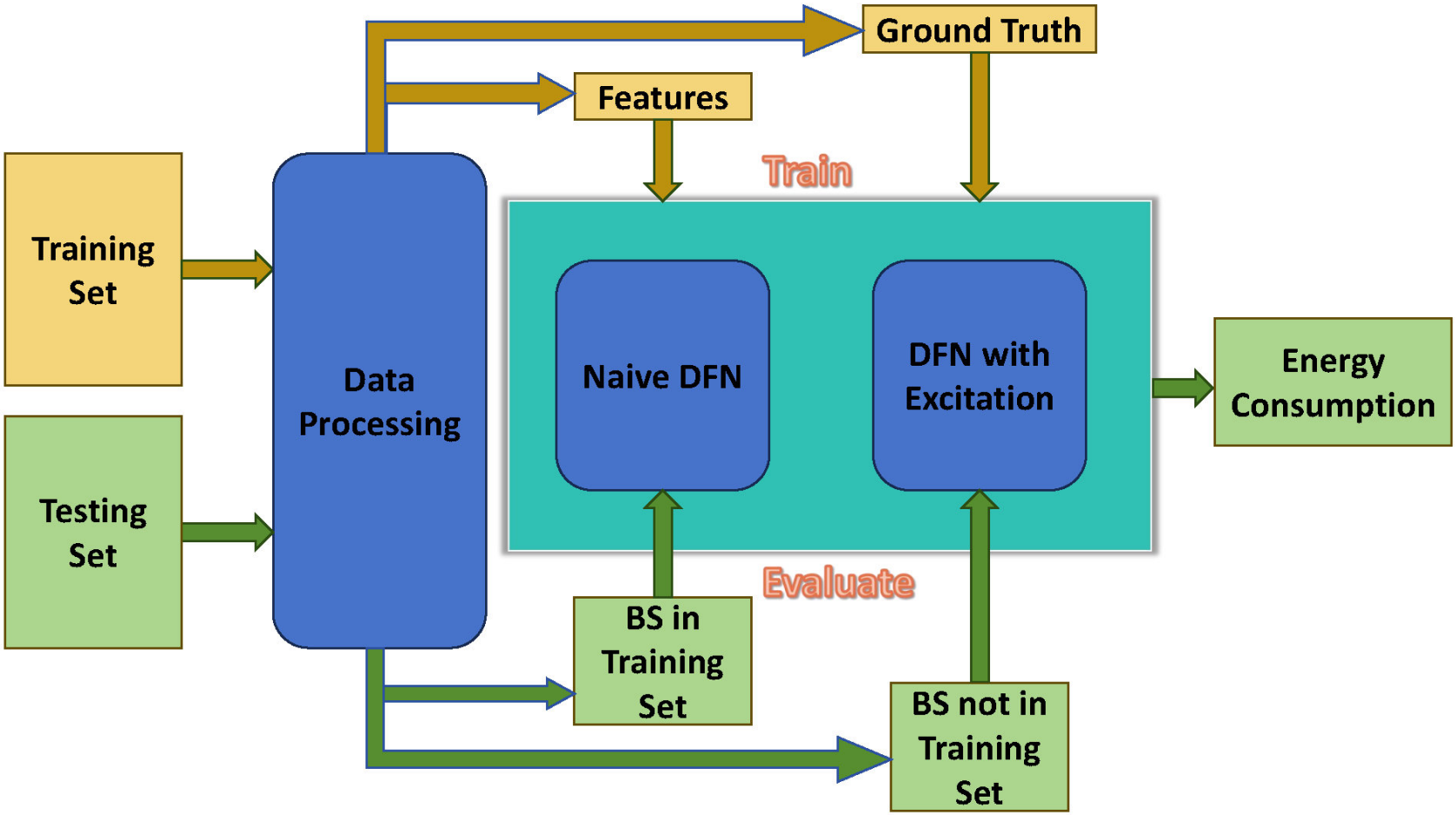

Figure: System Model

Data pre-processing

- Merge Base Station (BS) information and Cell level (CL) data
  - For all given base stations, the RUType and Mode remain consistent
  - Multiple Cells can be associated with a single BS

BS	Time	CellName	...	Load
BS_0	1/1/2023 1:00	Cell_0	...	0.48793617
		Cell_1	...	0
		Cell_2	...	0
		Cell_3	...	0

- Simplify data
  - A specific BS and Time can uniquely identify a data entry

BS	Time	Mode1	Mode2	RUType1	RUType2	...
BS_0	1/1/2023 1:00	0	1	1	0	...
...	ESMode1_cell0	ESMode1_cell1	...	Load_cell0	Load_cell1	...
...	0	0	...	0.48793617	...	...

- One-hot encoding:
  - BS, Time, Mode, RUType, Antennas, Bandwidth, Frequency
  - BS_0 $\rightarrow$ [1,0,0,...,0], BS_1 $\rightarrow$ [0,1,0,...,0], ...

Feature selection

Standard deviation (std):

- Drop features with std $= 0$
  - Model can focus on more valuable features
- Drop one-hot encoded features with std ≤ 0.01
  - Increase generalization ability

Methodology

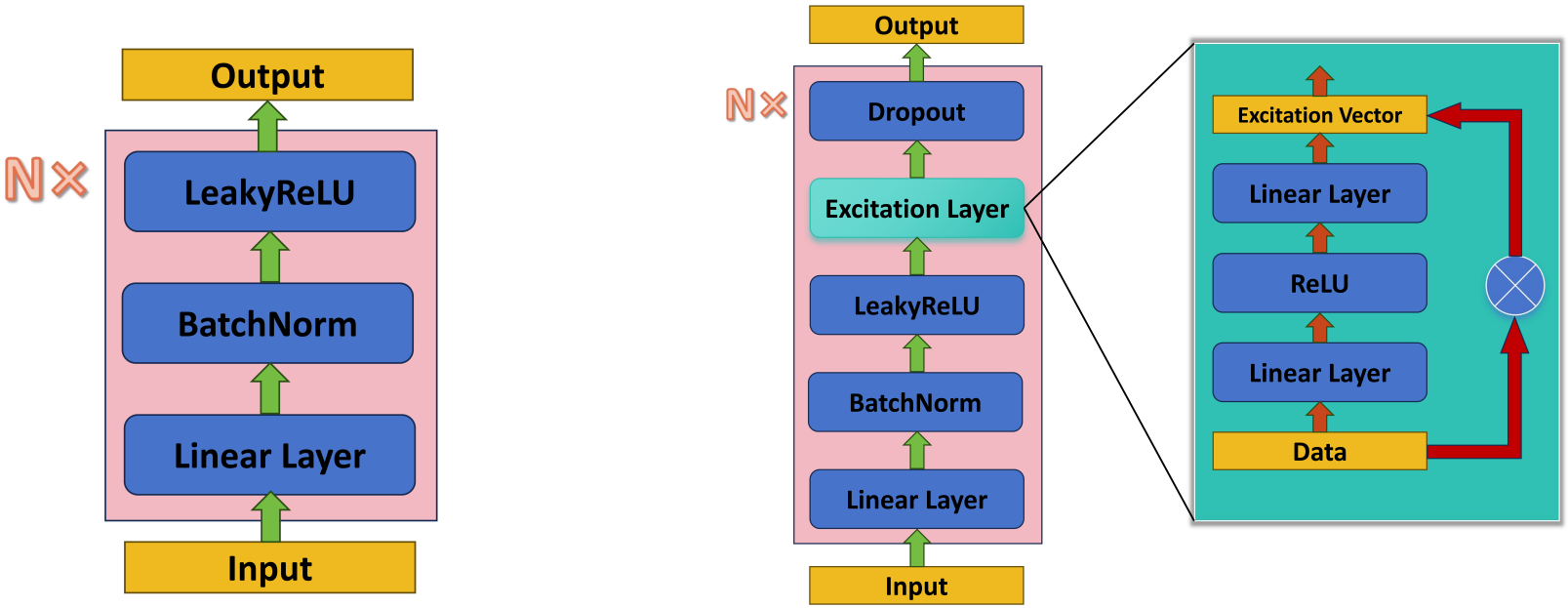

Figure: Network Architecture (Left: Naive DFN, Right: DFN with Excitation)

- Naive DFN: for BS in training data
- DFN with Excitation: fot BS not in training data

Experiment

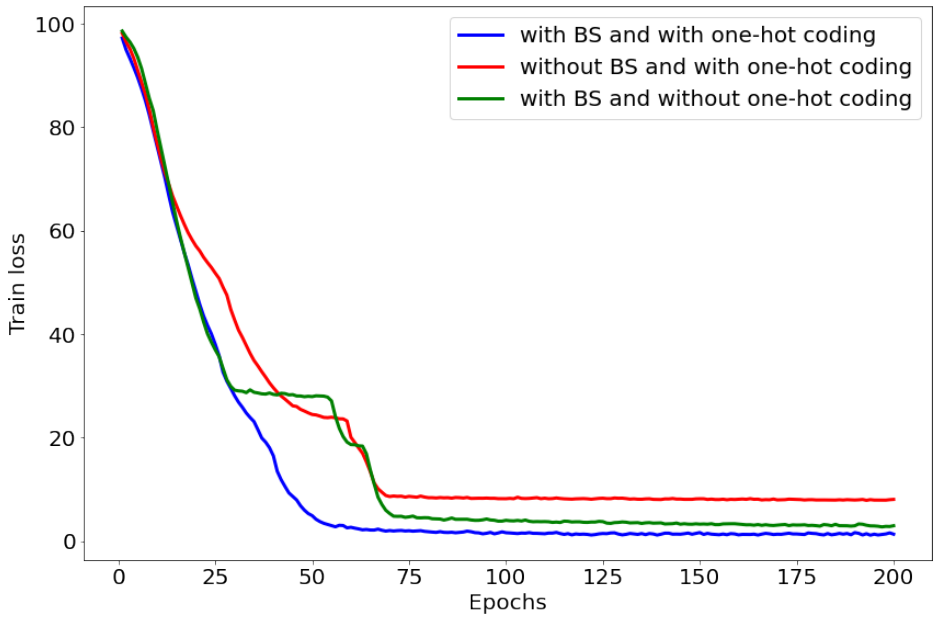

Figure: Experiment Result

- Ablation studies: Excitation Layer, One-Hot Encoding, BS Information
- Performance evaluation: low mean absolute percentage error (MAPE) across different BS products and configurations

Conclusion

- Hybrid feature selection method and attention mechanism
- Accuracy and generalization ability of our solution
- Provides foundation for future energy effecient optimization

Submissions

Select the two submissions on which you want to be scored on Zindi's private leaderboard for this competition. If you do not select any submissions, your best scoring public leaderboard submission will be considered your submission for scoring on the private leaderboard. While the competition is active, your best public score will be displayed on the leaderboard, irrespective of your current submission selections.

ID	SUBMITTED	SUBMITTER	FILE	PUBLIC SCORE	PRIVATE SCORE	COMMENT
GF8EhS2d	~7 hours ago	Teddy_ctw	power_cons...	0.077655853	0.079518761	–
15onam7P	~21 hours ago	Kuuhaku_wyt	power_cons...	0.053038349	0.053591067	–
2QnHSS5Q	~21 hours ago	Kuuhaku_wyt	power_cons...	0.053949952	0.054054136	–
DkwMPJJi	~21 hours ago	Kuuhaku_wyt	power_cons...	0.052383097	0.052922776	–
g37VbAzX	~21 hours ago	Kuuhaku_wyt	power_cons...	0.059223106	0.059603824	–

Figure: Public and private scores

Thank you!

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