

Report

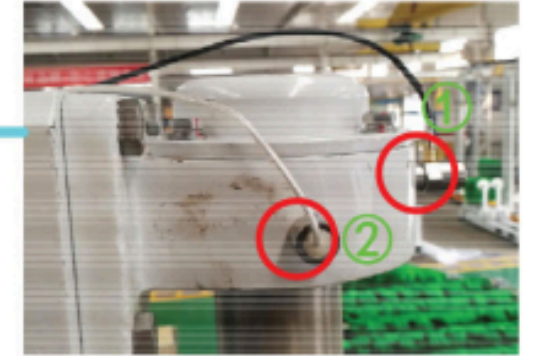
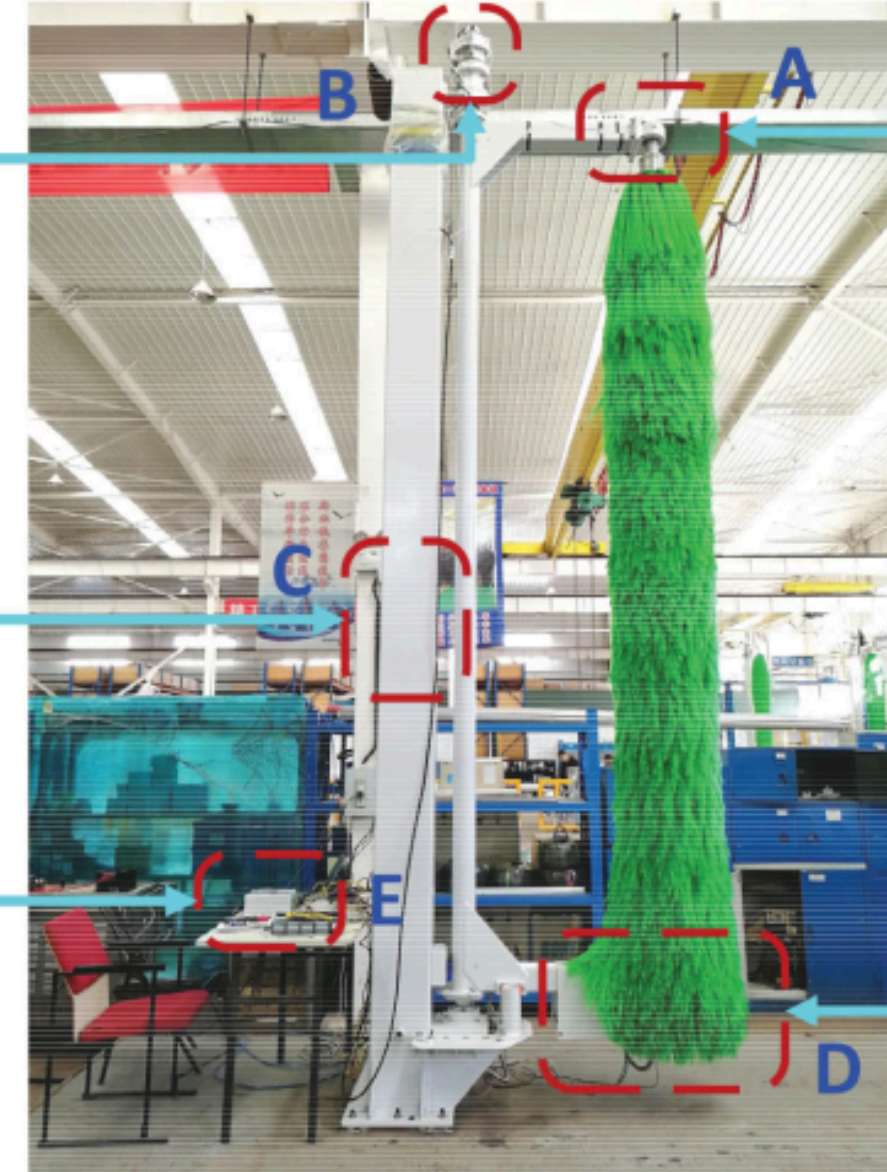
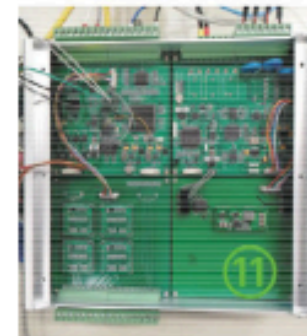
Presenter :Nguyễn Nam Khánh



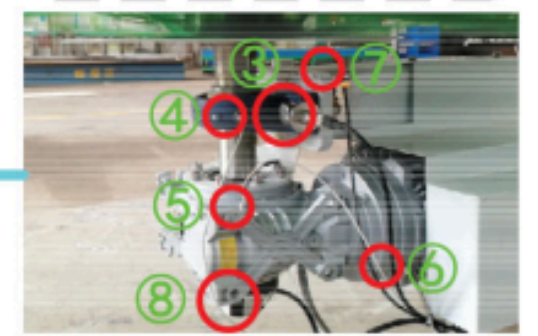
DeepHealth: A Self-Attention Based Method for Instant Intelligent Predictive Maintenance in Industrial Internet of Things

Weiting Zhang , *Student Member, IEEE*, Dong Yang , *Member, IEEE*, Youzhi Xu, Xuefeng Huang, Jun Zhang , and Mikael Gidlund , *Senior Member, IEEE*

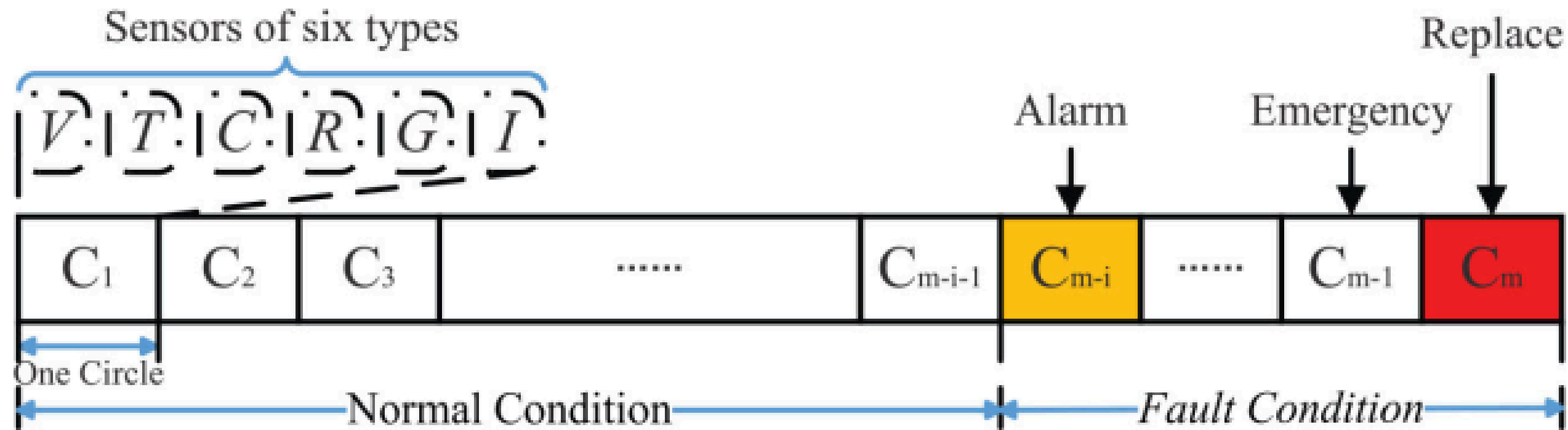
Paper purposes



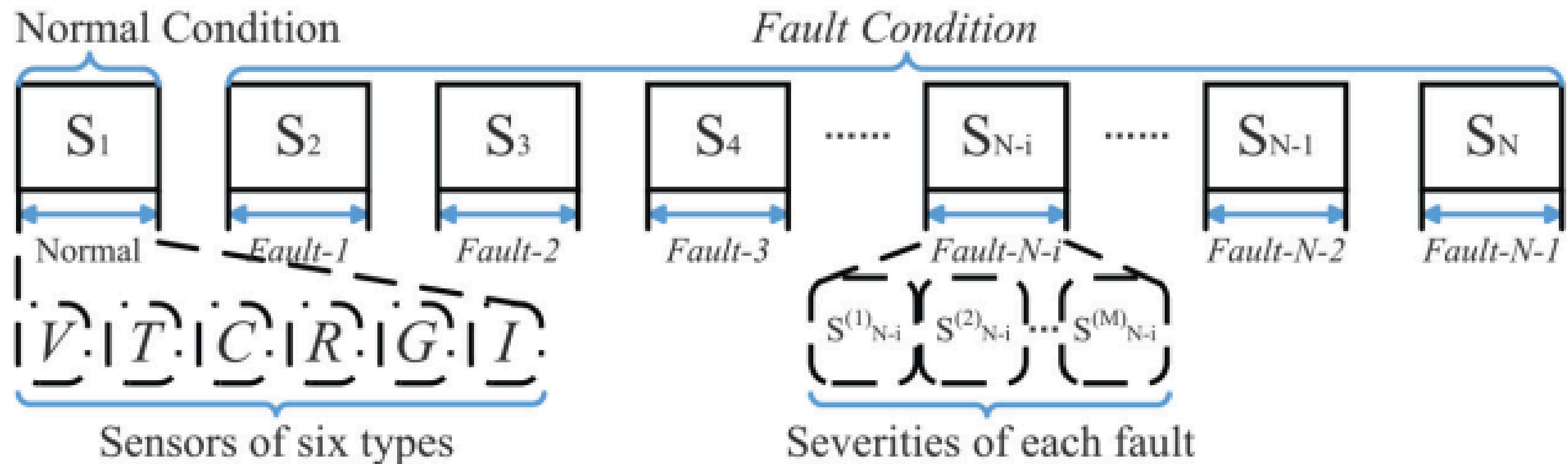
- (1) (3) : Accelerometer
- (2) (4) : Temperature
- (5) (6) : Temperature
- (7) : Rotation
- (8) : Gyro
- (9) : Inclination
- (10) : Current
- (11) : Gateway



Data extraction



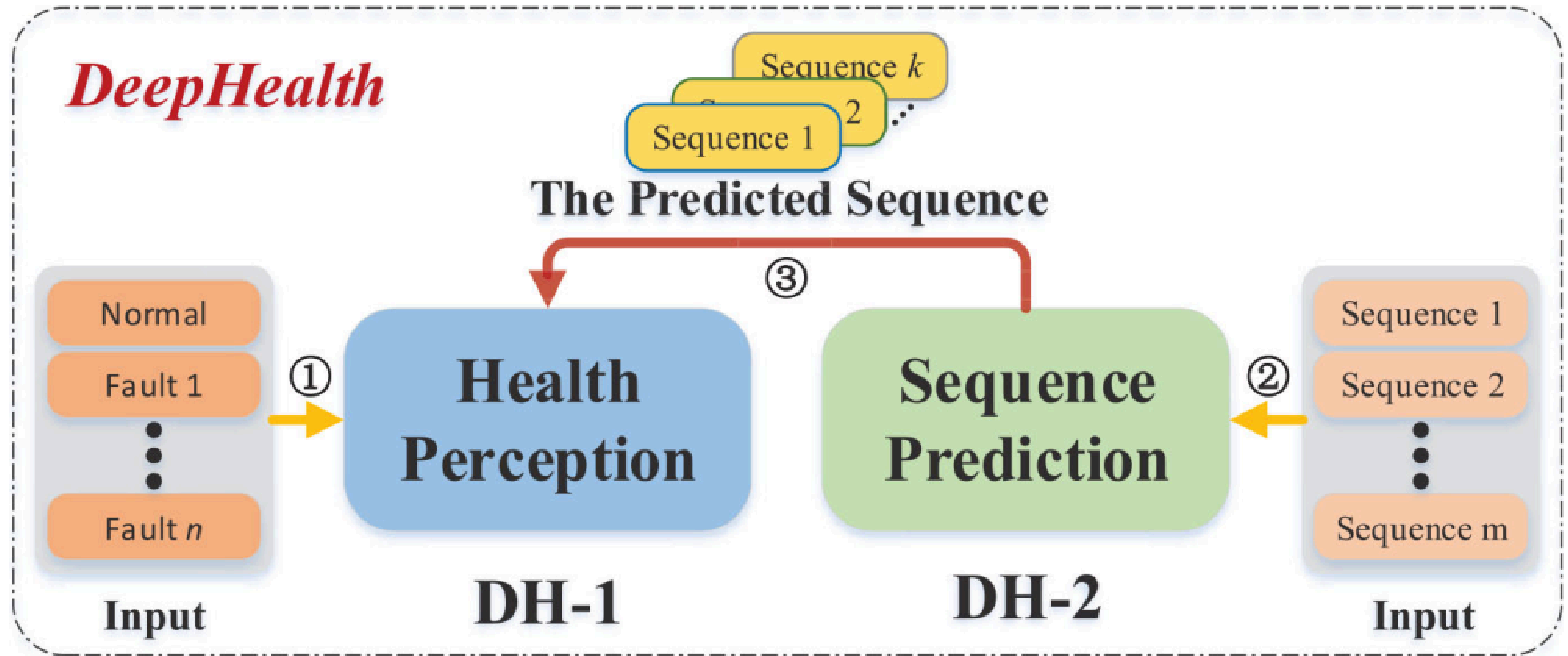
(a) Run to fail



(b) Destructive Scheme

(b)

Submodel structure



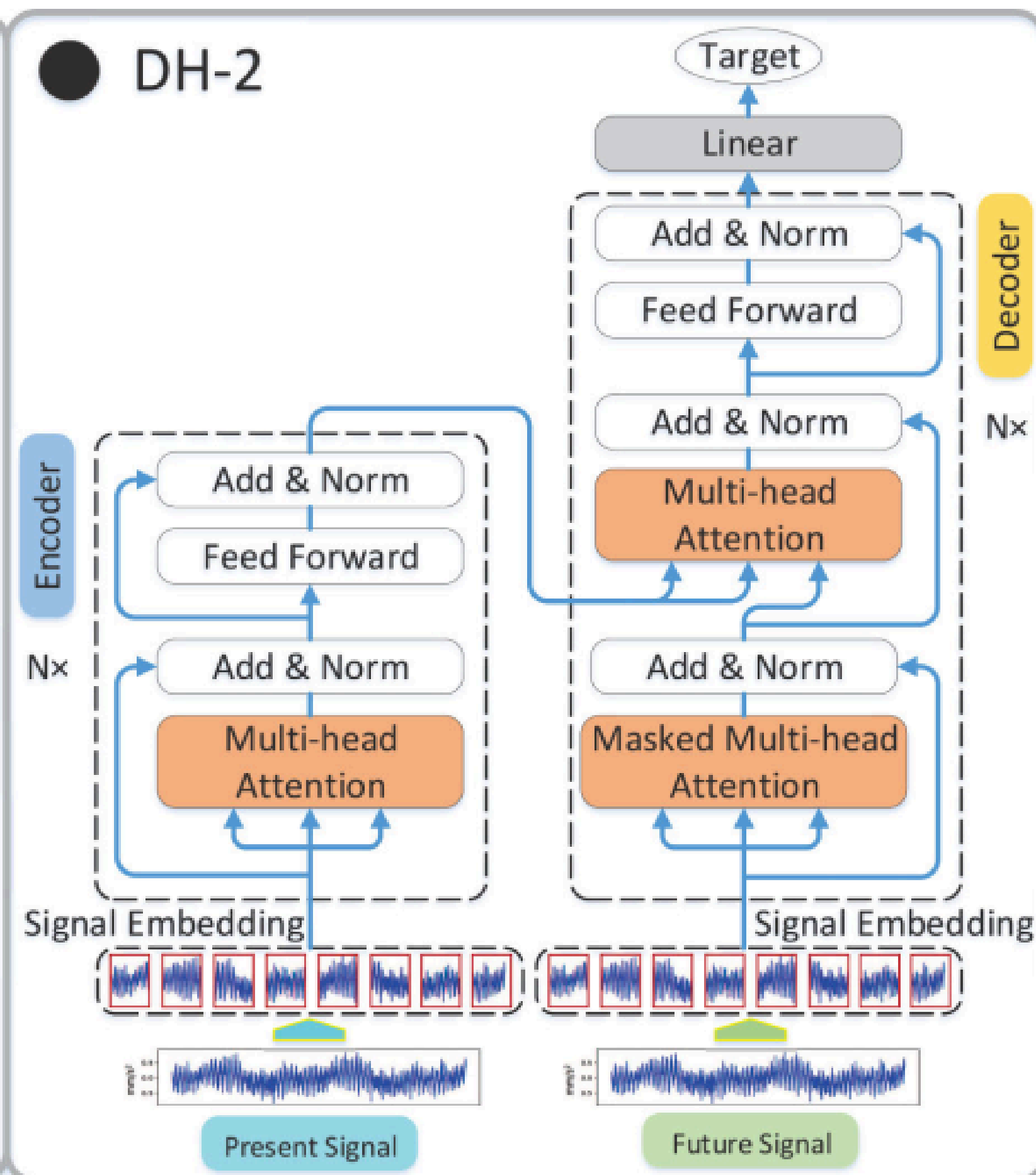
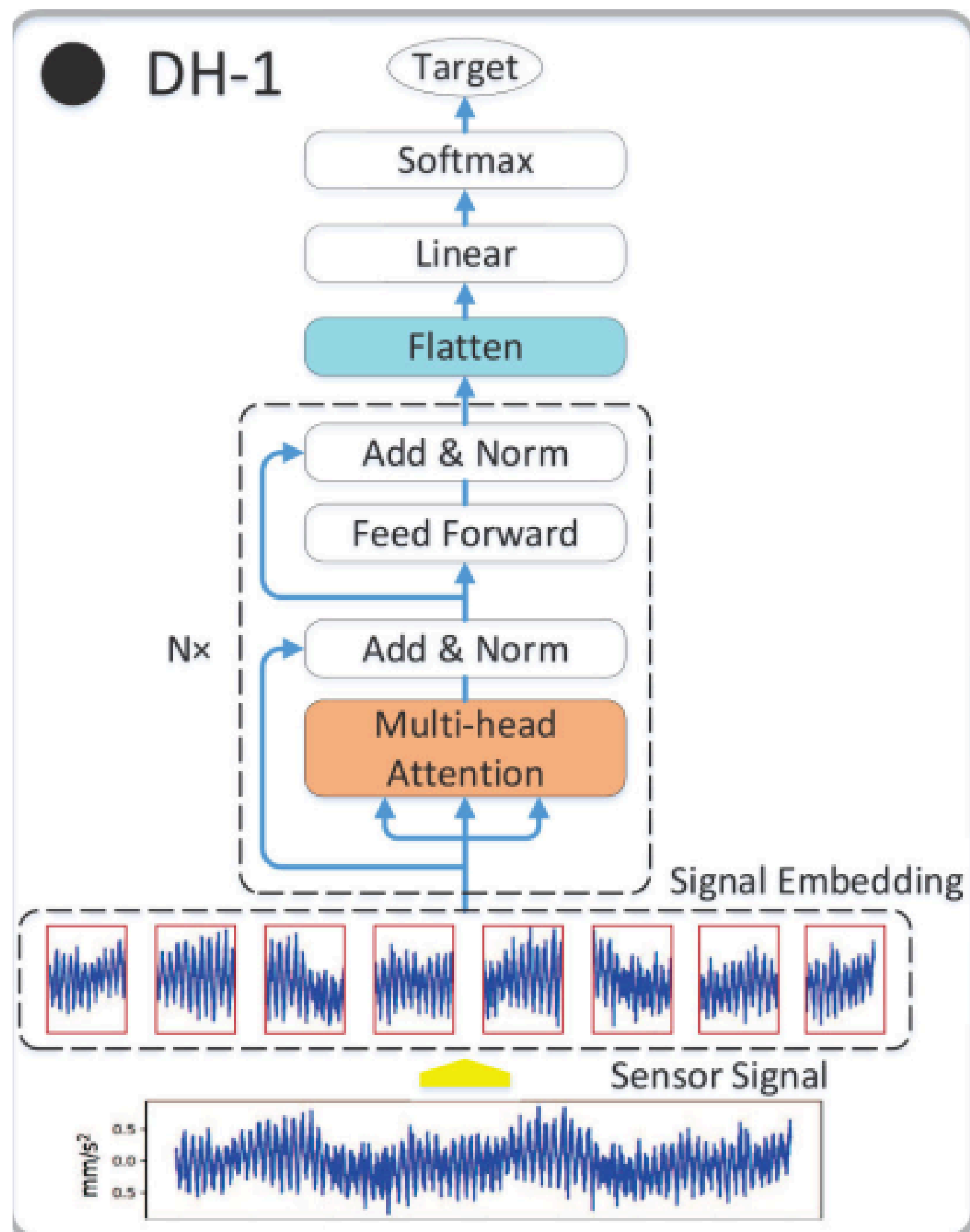


Table of training and testing time, accuracy, precision, recall, and F1-score of models DH-1 and DH-2 for each sequence length

TABLE I
DESCRIPTION OF THE TRAINING, EVALUATING, AND TESTING PROCESS OF DEEPHEALTH

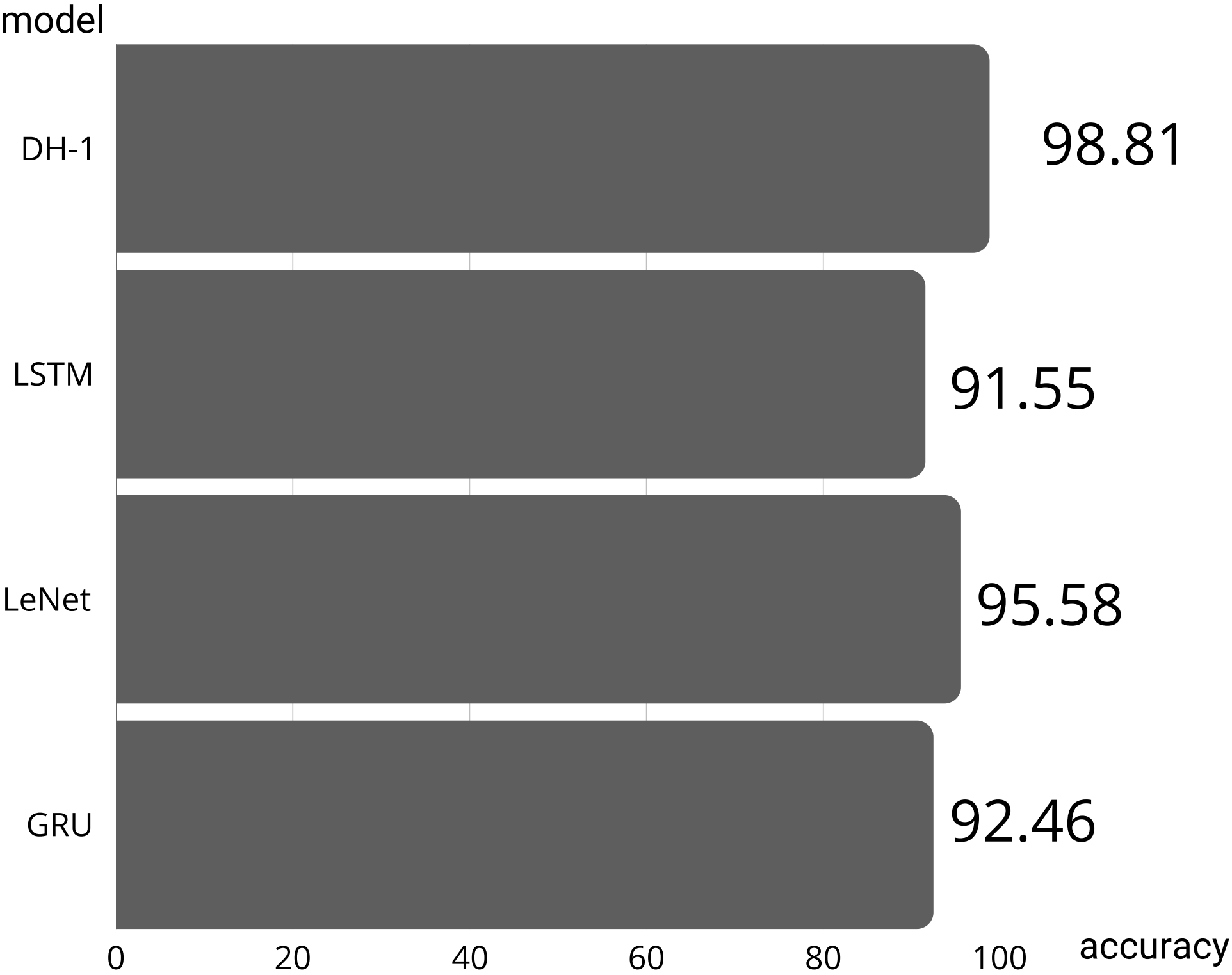
Dataset	Sequence length	Health Perception (DH-1)							Sequence Prediction (DH-2)			
		Data volume	Time consumption		Metrics (Testing)				Dataset descriptions		Time consumption	
			Train	Test	Accuracy	Precision	Recall	F1-score	Train/Valuate/Test	Total volume	Train	Test
Our (AWE)	128	187500	5980.5 s	1.292 s	69.52%	70.30%	69.52%	69.54%	172500/7499/7499	187498	5594.7 s	1.719 s
	256	93750	4505.9 s	1.165 s	95.87%	95.86%	95.87%	95.86%	84374/4687/4687	93748	6971.1 s	1.573 s
	512	46872	4109.6 s	0.983 s	98.78%	98.77%	98.78%	98.77%	42184/2343/2343	46870	5565.5 s	1.371 s
	1024	23436	4019.6 s	0.887 s	98.81%	98.80%	98.80%	98.80%	21092/1171/1171	23434	5602.2 s	1.275 s
	2048	11718	11874.8 s	1.047 s	98.29%	98.29%	98.29%	98.28%	10546/585/585	11716	17589.8 s	1.473 s
	4096	5859	21606.2 s	1.238 s	91.96%	91.95%	91.95%	91.96%	5270/292/292	5854	25411.1 s	1.794 s
CWRU	128	37760	1484.1 s	0.450 s	81.25%	81.45%	81.25%	81.26%	33984/1887/1887	37758	2520.9 s	0.774 s
	256	18880	906.2 s	0.352 s	85.80%	86.40%	85.80%	85.85%	16992/943/943	18878	1285.9 s	0.660 s
	512	16100	1399.2 s	0.441 s	93.41%	93.61%	93.41%	93.38%	8496/471/471	9438	1093.9 s	0.650 s
	1024	16080	2801.7 s	0.672 s	98.32%	98.32%	98.32%	98.32%	4248/235/235	4718	1149.6 s	0.615 s
	2048	16050	15816.8 s	1.225 s	99.56%	99.57%	99.56%	99.56%	2124/117/117	2358	6122.7 s	0.647 s
	4096	15980	55860.2 s	3.253 s	99.88%	99.88%	99.87%	99.87%	1062/58/58	1178	10533.9 s	0.704 s

Note: Due to the limited data volume of the CWRU dataset, we therefore deploy a data augmentation method called equitable sliding stride segmentation (ESSS) [33] for the sequence lengths of 512, 1024, 2048, and 4096.

Model accuracy

TABLE II
COMPARISONS OF SEVERAL ALGORITHMS ON THE AWE DATASET

Method	Length of Input	Accuracy
LSTM	256	91.55%
GRU	256	92.46%
LeNet	1024	95.58%
DH-1	1024	98.81%

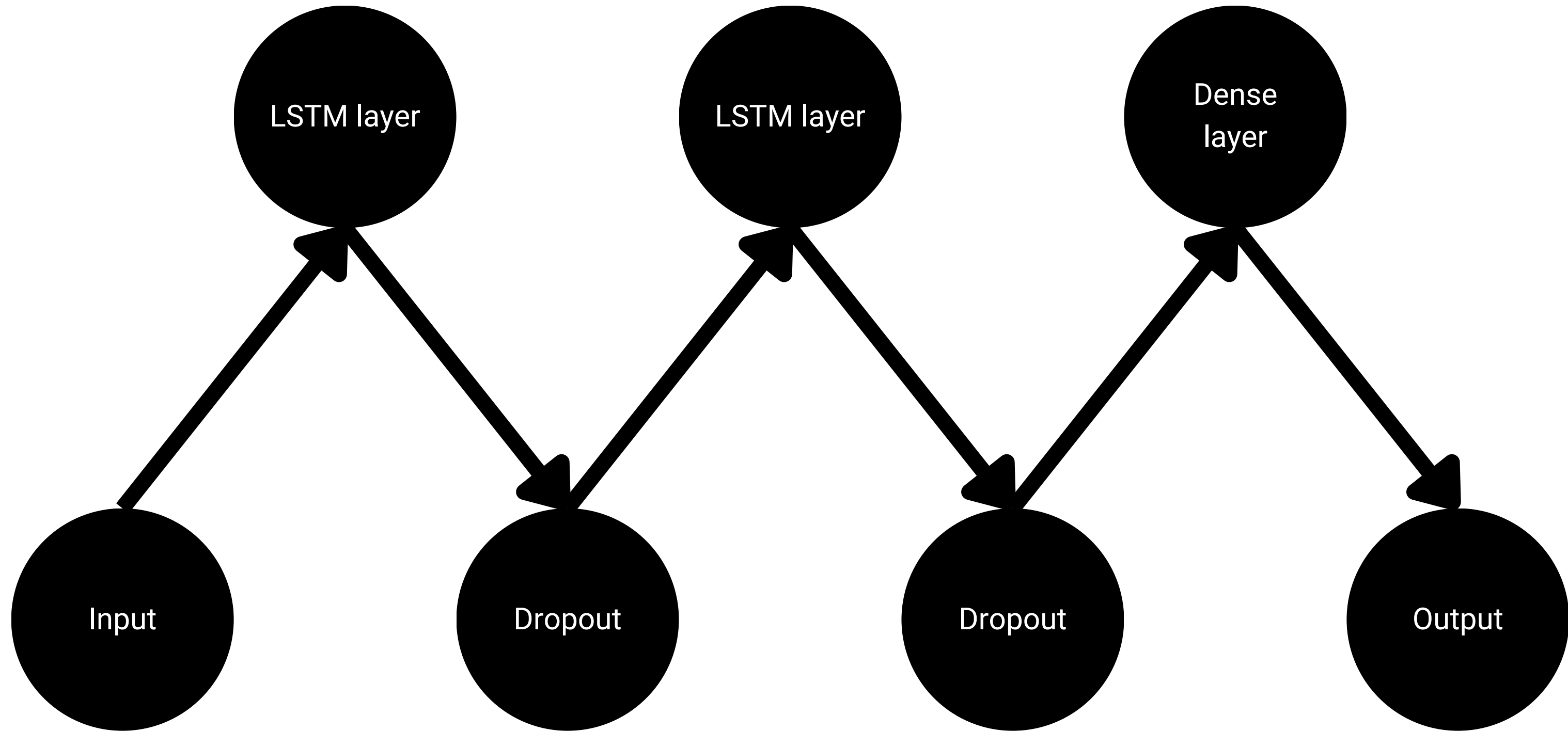


Model accuracy, trainning time, testing time

	DH-1			LSTM		
	Accuracy	Trainning time	Testing time	Accuracy	Trainning time	Testing time
1	97,396	1640,839	0,652	99	651,075	0,158
2	97,951	1646,501	0,512	98,76	543,246	0,153
3	97,183	1598,725	0,492	98,76	509,333	0,156
4	97,354	1616,689	0,503	98,46	530,845	0,157
5	97,567	1813,383	0,51	99,19	628,995	0,182

Length of input: 1024

Structure of model LSTM



DH-2 performance

	RMSE	MAE	Trainning time	Testing time
1	0.0236	0.0193	5024.338	0.591
2	0.0242	0.0198	4257.084	0.725
3	0.0277	0.185	3957.851	0.395
4	0.0248	0.0203	4196.397	0.441
5	0.0239	0.0196	4599.419	0.557
6	0.0241	0.0194	7333.717	2.82