

Peeky Decoder and Attention experimentation

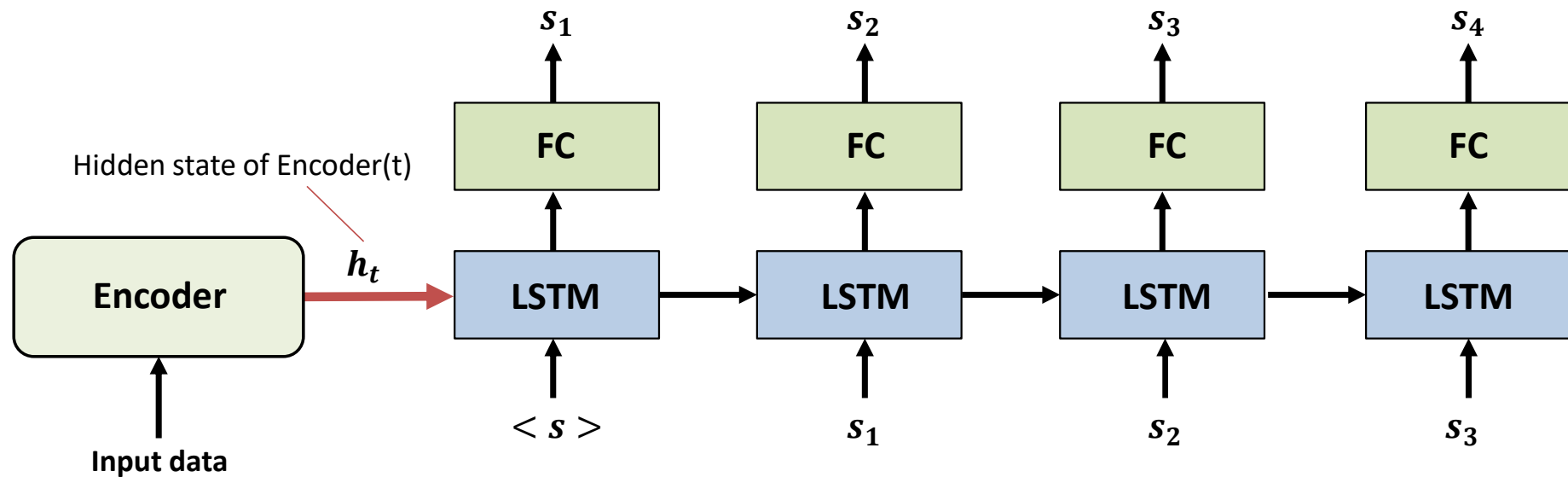
Peeky 디코더, 어텐션 실험 결과

Geonil Yun,
rjsdlf45@gmail.com
2021. 08. 03.



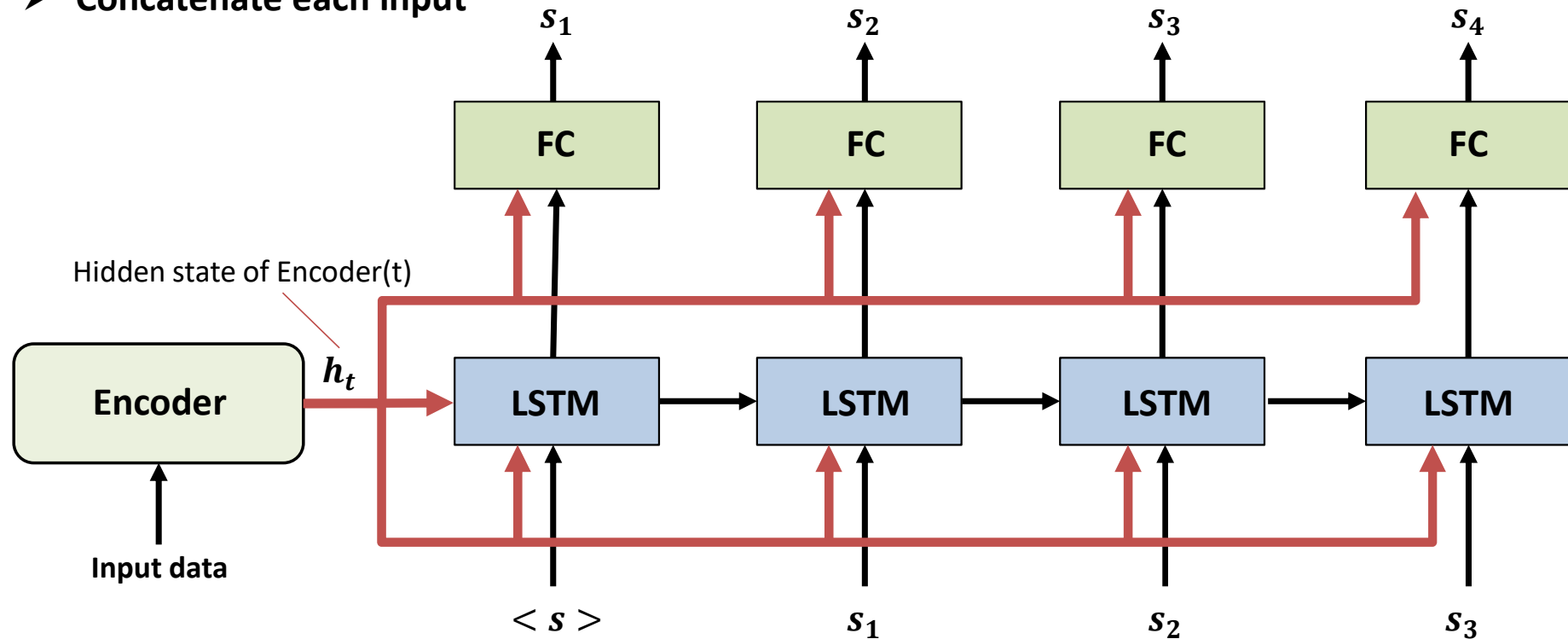
Experimental setting

- Decoder
 - Only first LSTM cell use output of Encoder state



Experimental setting

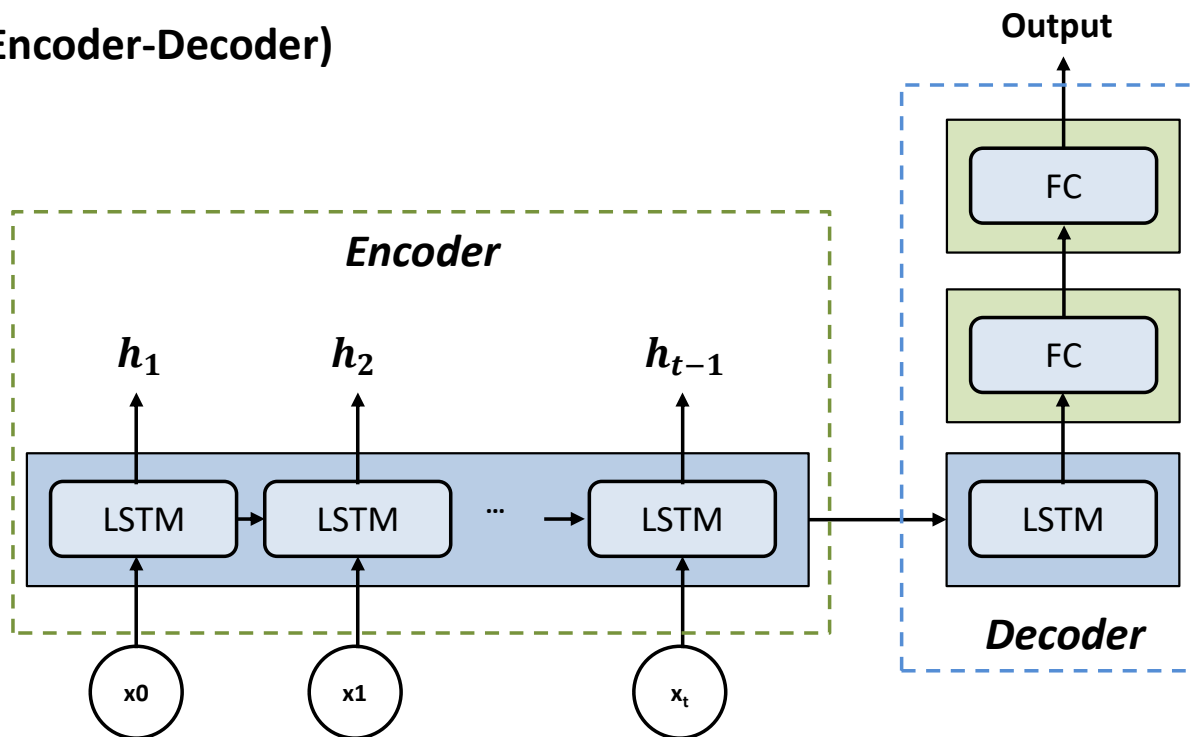
- Peeky Decoder
 - Using output of Encoder state in every step
 - Concatenate each input



Experimental setting

- Model Structure

Structure (Encoder-Decoder)

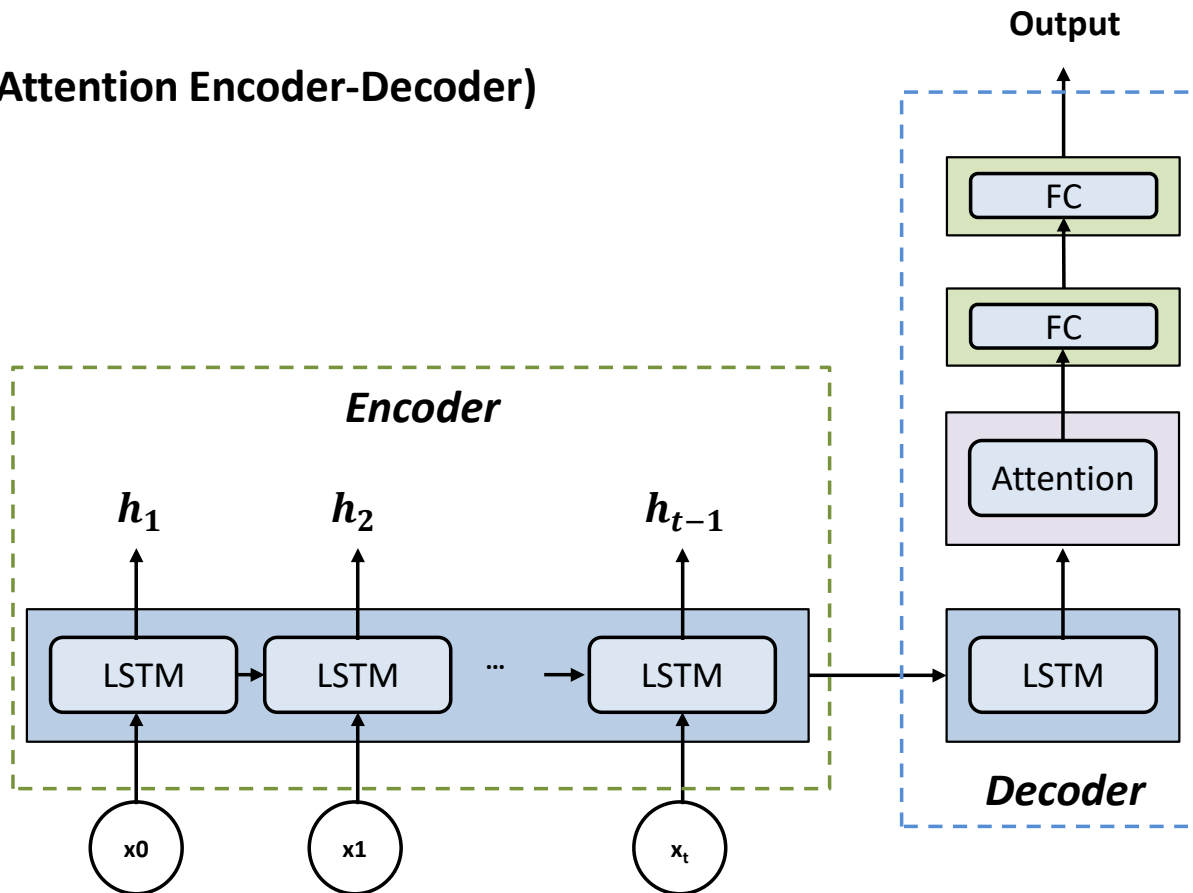


- input data shape : (batch, time step, features)

Experimental setting

- Model Structure

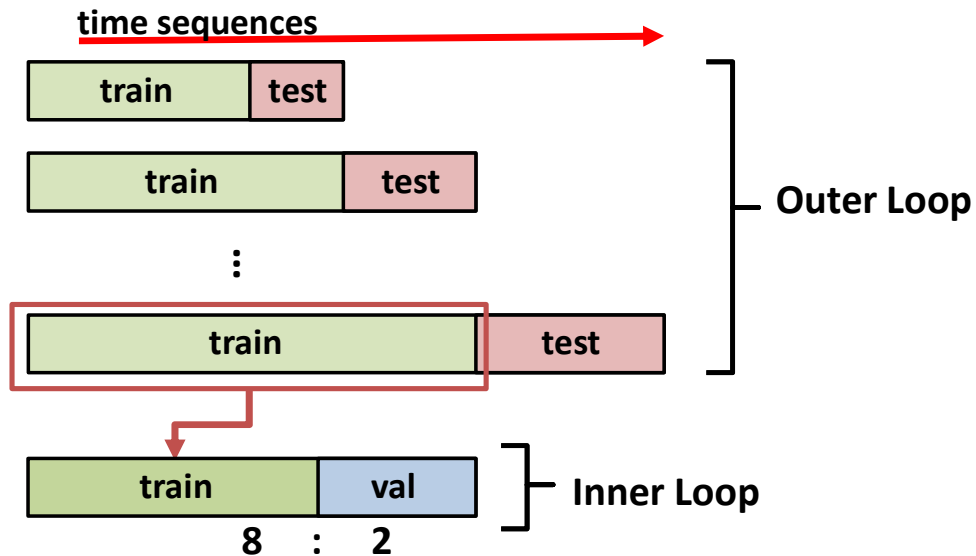
Structure (Attention Encoder-Decoder)



- input data shape : (batch, time step, features)

Experimental setting

- Nested Cross Validation for time series



- train **past** data & predict **future** data
- handling time series data in Nested CV

- hyperparameter

Model	CNN (ShuffleNet)	RNN(LSTM, GRU)
fold num	10	
hidden size	64	
input length	24	
output length	1	
epoch	30	
batch size	32 or 64	
learning rate	0.01, 0.001	

- batch size 32 for ISE, Chickenpox dataset
- batch size 64 for others

Experimental setting

- Statistics

Dataset		Mean	Standard Deviation	Skewness	Kurtosis	Jarque Bera	ADF
Air Quality		1099.833	217.080	0.755	0.334	897.811	-9.823
Appliances Energy		97.694	102.524	3.386	13.664	191240.781	-21.616
Beijing Air Pollution		98.613	92.050	1.802	4.768	62162.743	-20.606
Hungarian Chickenpox		101.245	76.354	0.948	1.400	121.010	-6.933
Electric Consumption		1.483	1.194	1.141	1.732	3421.560	-5.360
Eye State		0.448	0.497	0.205	-1.957	2497.788	-4.803
Istanbul Stock Exchange	ISE	0.0016	0.016	-0.094	1.391	44.022	-22.746
	SP	0.0006	0.014	-0.090	3.068	211.013	-11.031
	DAX	0.0007	0.014	-0.106	2.104	99.894	-23.056
Metro Volume		3259.818	1986.860	-0.089	-1.309	3506.110	-28.016
Occupancy Detection		0.212	0.408	1.406	-0.020	2686.285	-3.430
SML 2010		20.493	3.312	-0.169	-0.105	21.792	-4.314

*ISE : Istanbul Stock Exchange, *SP : Standard & Poor's, *DAX : Germany

Comparison results

- Training time [s]

Data		Shuffle Net	LSTM	GRU	LSTM Enc-Dec	Peeky Enc-Dec	Attention
Air Quality		85.945	111.179	204.589	89.308	91.354	94.083
Appliances Energy		193.282	253.574	466.305	199.922	208.617	207.069
Beijing Air Pollution		99.431	127.850	237.616	99.871	111.791	111.420
Hungary Chickenpox		8.842	11.399	20.961	8.939	9.123	8.969
Electric Consumption		100.391	130.031	241.473	103.709	111.695	107.406
Eye State		154.765	198.695	361.457	156.921	155.071	151.706
Istanbul Stock Exchange	ISE	9.133	12.116	21.743	9.346	9.718	9.662
	SP	9.142	11.667	22.085	9.214	9.456	9.329
	DAX	9.271	11.812	22.005	9.536	9.760	10.209
Metro Interstate Traffic Volume		492.337	615.670	1135.469	494.463	522.670	569.504
Occupancy Detection		81.002	105.606	192.808	81.802	87.421	86.245
SML 2010		41.084	52.834	98.692	45.577	42.458	41.622

Comparison results

- RMSE (Root Mean Squared Error)

Data		Shuffle Net	Standard Deviation	LSTM	Standard Deviation	GRU	Standard Deviation	LSTM Enc-Dec	Standard Deviation	Peeky LSTM Enc-Dec	Standard Deviation	Attention	Standard Deviation
Air Quality		147.489	33.383	103.805	25.297	295.904	256.525	219.623	37.670	265.302	55.871	260.729	50.303
Appliances Energy		72.338	8.558	72.563	22.345	184.684	244.671	115.048	16.848	121.259	9.743	118.573	10.732
Beijing Air Pollution		48.369	11.659	26.796	8.089	99.672	61.693	114.960	30.855	123.869	34.940	121.149	35.060
Hungary Chickenpox		63.992	17.450	53.865	15.022	80.651	30.074	79.734	13.288	84.515	14.975	84.197	12.131
Electric Consumption		0.848	0.357	0.294	0.238	1.228	1.397	1.319	0.512	1.329	0.050	1.325	0.498
Eye State		0.059	0.074	3.012	4.770	3.531	3.895	0.558	0.098	0.567	0.093	0.581	0.080
Istanbul Stock Exchange	ISE	0.028	0.007	6.235	6.343	1.259	0.585	0.015	0.003	0.016	0.005	0.015	0.003
	SP	0.022	0.009	5.557	5.713	2.803	3.791	0.011	0.003	0.011	0.003	0.011	0.003
	DAX	0.024	0.009	4.771	5.510	2.582	3.354	0.012	0.003	0.013	0.005	0.013	0.004
Metro Interstate Traffic Volume		864.935	252.857	527.695	125.450	2261.804	1003.633	2753.330	35.901	2759.759	41.104	2748.741	46.494
Occupancy Detection		0.388	0.151	1.737	2.729	0.955	0.847	0.350	0.250	0.389	0.250	0.400	0.263
SML 2010		2.512	1.128	0.310	0.219	5.659	7.295	3.004	0.431	2.967	0.440	3.014	0.412

Comparison results

- RMSE (Root Mean Squared Error)

Data		Shuffle Net	Standard Deviation	LSTM	Standard Deviation	GRU	Standard Deviation	LSTM Enc-Dec	Standard Deviation	Peeky LSTM Enc-Dec	Standard Deviation	Attention	Standard Deviation
Air Quality		112.998	25.412	79.423	24.508	258.354	264.234	178.951	28.710	212.662	44.937	208.368	41.724
Appliances Energy		34.821	6.233	39.905	20.294	150.641	253.860	68.152	9.661	71.405	5.285	68.478	7.531
Beijing Air Pollution		31.581	5.880	16.690	4.281	81.923	63.357	83.815	21.095	89.182	22.433	87.184	22.890
Hungary Chickenpox		47.789	11.065	36.731	10.603	65.710	25.898	64.664	9.994	66.987	11.666	67.890	10.240
Electric Consumption		0.623	0.294	0.121	0.086	1.035	1.296	0.971	0.438	0.978	0.436	0.976	0.427
Eye State		0.469	0.068	2.690	4.789	3.499	3.909	0.528	0.074	0.527	0.077	0.523	0.066
Istanbul Stock Exchange	ISE	0.022	0.006	6.233	6.344	1.254	0.587	0.011	0.002	0.013	0.004	0.019	0.002
	SP	0.017	0.008	5.555	5.713	2.796	3.787	0.008	0.002	0.008	0.002	0.008	0.002
	DAX	0.019	0.007	4.768	5.511	2.576	3.349	0.009	0.002	0.010	0.004	0.010	0.003
Metro Interstate Traffic Volume		576.552	166.768	343.280	70.116	1925.708	918.449	2236.276	28.966	2241.299	32.982	2232.882	37.228
Occupancy Detection		0.222	0.097	1.492	2.202	0.836	0.851	0.226	0.181	0.261	0.184	0.280	0.209
SML 2010		2.321	1.146	0.256	0.188	5.322	7.368	2.436	0.356	2.408	0.362	2.444	0.338

Thank you

Appendix : Shuffle Net Architecture

Layer	Output size	KSize	Stride	Repeat	Output channels (g groups)				
					$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 8$
Image	224×224				3	3	3	3	3
Conv1	112×112	3×3	2	1	24	24	24	24	24
MaxPool	56×56	3×3	2						
Stage2	28×28		2	1	144	200	240	272	384
	28×28		1	3	144	200	240	272	384
Stage3	14×14		2	1	288	400	480	544	768
	14×14		1	7	288	400	480	544	768
Stage4	7×7		2	1	576	800	960	1088	1536
	7×7		1	3	576	800	960	1088	1536
GlobalPool	1×1	7×7							
FC					1000	1000	1000	1000	1000
Complexity					143M	140M	137M	133M	137M

Appendix : Dataset

Dataset	references
Air Quality	https://archive.ics.uci.edu/ml/machine-learning-databases/00360/
Appliances Energy	https://archive.ics.uci.edu/ml/machine-learning-databases/00374/
Beijing Air Pollution	https://archive.ics.uci.edu/ml/machine-learning-databases/00381/
Hungarian Chickenpox	https://archive.ics.uci.edu/ml/machine-learning-databases/00580/
Electric Consumption	https://archive.ics.uci.edu/ml/machine-learning-databases/00235/
Eye State	https://archive.ics.uci.edu/ml/machine-learning-databases/00264/
Istanbul Stock Exchange	https://archive.ics.uci.edu/ml/machine-learning-databases/00247/
Metro Volume	https://archive.ics.uci.edu/ml/machine-learning-databases/00492/
Occupancy Detection	https://archive.ics.uci.edu/ml/machine-learning-databases/00357/
SML 2010	https://archive.ics.uci.edu/ml/machine-learning-databases/00274/