HW5 Report
Gina Roh

1. Explain your approach to this classification problem.

```
Model: "sequential"
_____
 Layer (type)                  Output Shape              Param #
=================================================================
 hidden (Dense)                (None, 6)                 42

 output (Dense)                (None, 3)                 21


=================================================================
Total params: 63 (252.00 Byte)
Trainable params: 63 (252.00 Byte)
Non-trainable params: 0 (0.00 Byte)
```

- 1 hidden layer 6-6-3 neural network to solve this classification problem.
- Activation function of Hidden layer: ReLU
- Activation function of Output layer: Softmax
- Loss function: sparse_categorical_crossentropy
- Optimizer: adam with learning rate 0.01
- Evaluate metrics: Loss and Accuracy

I developed a neural network with a 6-3-3 architecture for a multi-class classification task. In this problem, I have three classes: Low (0), Medium (1), and High (2). The network's output consists of three nodes, each representing the likelihood of belonging to one of these classes. For example, a prediction might look like [9.04039407e-05 7.26417542e-01 2.73492068e-01].

In the hidden layer, I applied the ReLU activation function because it performed better than the sigmoid function in this problem. Sigmoid tends to flatten out for extreme input values. In the output layer, I used the Softmax activation function to compute the probabilities for each class, ensuring that the values range from 0 to 1.

For the loss function, I opted for 'sparse_categorical_crossentropy' since we are dealing with a multi-class classification problem, and I represented the target labels as unique integers rather than one-hot encoding.

To train the model, I used the Adam optimizer with a learning rate of 0.01.

During evaluation, I considered accuracy as the primary metric to gauge how effectively the model can classify data.

2. Comment on your results.

Training Results

The loss consistently decreases as the model continues to train. While the accuracy exhibits fluctuations with occasional ups and downs because of the small size of the dataset, it generally demonstrates an upward trends.

Upon reaching the 200th epoch, the final training metrics are as follows:

- loss: 0.3850 - accuracy: 0.8625
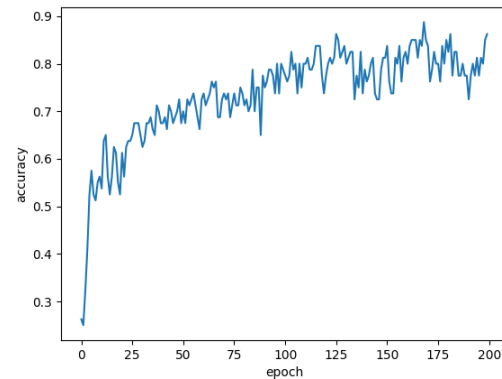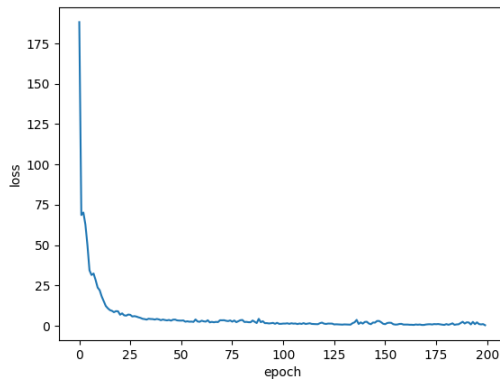
Test Results

Please refer to the last column, labeled 'predict,' to view the prediction results. The target values are in the 'category' column.

The prediction metrics are as follows:

- loss: 0.7344 - accuracy: 0.7500

	univ_rank	first_initial	last_initial	cit_2017	cit_2018	cit_2019	cit_2020	cit_2021	cit_2022	h_index	i_10_index	ratio	category	predict
0	51	I	P	38	102	159	245	277	381	16	24	1.38	2	2
1	51	S	M	153	333	510	749	963	1048	31	59	1.09	1	1
2	51	A	B	5524	8950	12526	14204	16734	17508	60	88	1.05	1	1
3	51	W	H	161	183	206	215	179	262	22	33	1.46	2	2
4	51	F	N	70	96	88	133	157	156	16	24	0.99	0	1
5	51	M	I	238	386	641	602	1025	1249	41	110	1.22	2	2
6	51	R	F	41	115	210	312	473	554	15	21	1.17	2	2
7	51	S	J	54	72	113	139	144	141	9	9	0.98	0	0
8	51	S	Z	135	92	160	184	238	332	24	34	1.39	2	2
9	51	J	Z	1678	2066	2635	3253	4319	4125	23	30	0.96	0	0
10	52	E	G	151	147	156	152	169	167	31	85	0.99	0	1
11	52	M	C	85	121	202	264	376	383	28	65	1.02	0	1
12	52	W	E	1375	1264	1038	998	947	784	37	65	0.83	0	1
13	52	A	D	183	286	356	395	449	490	22	31	1.09	1	1
14	52	R	C	89	128	103	109	108	103	20	39	0.95	0	1
15	52	V	C	19	22	52	116	172	188	13	21	1.09	1	1
16	52	T	B	503	463	584	722	945	893	46	163	0.94	0	0
17	52	W	A	47	82	98	128	178	346	17	35	1.94	2	2
18	52	K	A	139	125	84	80	74	47	16	24	0.64	0	0
19	52	S	H	205	201	220	210	202	187	21	29	0.93	0	0