

به نام خدا

گزارش پروژه اول درس یادگیری عمیق

دکتر سید ابوالقاسم میرروشندل

تاریخ تحویل: 1401/01/15

نام و نام خانوادگی	معصومه مختاری
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• نتایج به ازای مقداردهی اولیه رندوم

مقدار α و $k: 0.1$ و 1000				
تعداد لایه	Loss و Accuracy بهترین مدل (بر اساس کمترین Loss) - مجموعه آموزش	Loss و Accuracy بهترین مدل (بر اساس کمترین Loss) - مجموعه ارزیابی	Loss و Accuracy بهترین مدل (بر اساس بیشترین Accuracy) - مجموعه آموزش	Loss و Accuracy بهترین مدل (بر اساس بیشترین Accuracy) - مجموعه ارزیابی
2	Acc: 0.8489583333333334, Loss: 0.10072961895647252	Acc: 0.78125, Loss: 0.15025344807107235	Acc: 0.8515625, Loss: 0.1070066502547291	Acc: 0.8229166666666666, Loss: 0.15333400119146445
3	Acc: 0.984375, Loss: 0.01617058608797294	Acc: 0.8541666666666666, Loss: 0.128368702306722	Acc: 0.984375, Loss: 0.018105598126555184	Acc: 0.8645833333333334, Loss: 0.12931692445929543
5	Acc: 0.9791666666666666, Loss: 0.019956735720060226	Acc: 0.8333333333333334, Loss: 0.13463087134577284	Acc: 0.9791666666666666, Loss: 0.019956735720060226	Acc: 0.8333333333333334, Loss: 0.13463087134577284

○ تعداد لایه=2:

▪ شکل خروجی کد (Loss و Accuracy) مجموعه آموزش

قسمتی از خروجی:

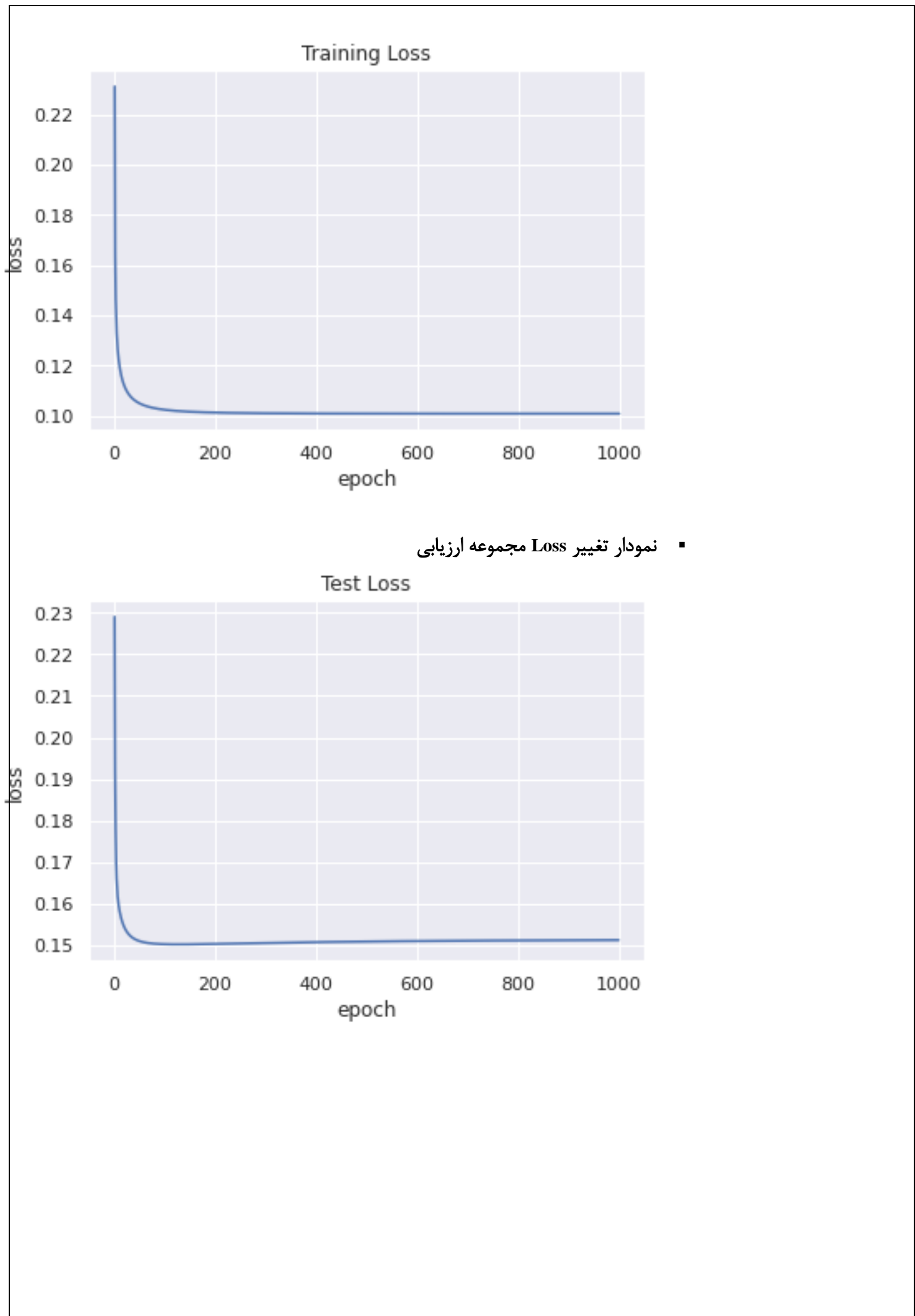
```
Epoch: 221, Accuracy: 0.84375, Loss: 0.10106318347999149
Epoch: 231, Accuracy: 0.84375, Loss: 0.10102937229647638
Epoch: 241, Accuracy: 0.84375, Loss: 0.10099939430103667
Epoch: 251, Accuracy: 0.84375, Loss: 0.10097273499840205
Epoch: 261, Accuracy: 0.84375, Loss: 0.10094896236609664
Epoch: 271, Accuracy: 0.84375, Loss: 0.10092771136790701
Epoch: 281, Accuracy: 0.84375, Loss: 0.10090867179258695
```

Epoch: 291, Accuracy: 0.84375, Loss: 0.10089157861838663
Epoch: 301, Accuracy: 0.84375, Loss: 0.100876204315572
Epoch: 311, Accuracy: 0.84375, Loss: 0.10086235264984722
Epoch: 321, Accuracy: 0.8463541666666666, Loss: 0.10084985365831105
Epoch: 331, Accuracy: 0.8463541666666666, Loss: 0.1008385595488648
Epoch: 341, Accuracy: 0.8463541666666666, Loss: 0.10082834133243111
Epoch: 351, Accuracy: 0.8463541666666666, Loss: 0.10081908604083148
Epoch: 361, Accuracy: 0.84375, Loss: 0.10081069441585004
Epoch: 371, Accuracy: 0.84375, Loss: 0.10080307897975636
Epoch: 381, Accuracy: 0.84375, Loss: 0.10079616241648046
Epoch: 391, Accuracy: 0.84375, Loss: 0.10078987620717746
Epoch: 401, Accuracy: 0.84375, Loss: 0.10078415947521402
Epoch: 411, Accuracy: 0.84375, Loss: 0.10077895800441056
Epoch: 421, Accuracy: 0.84375, Loss: 0.10077422340130031
Epoch: 431, Accuracy: 0.84375, Loss: 0.10076991237763307
Epoch: 441, Accuracy: 0.84375, Loss: 0.10076598613370677
Epoch: 451, Accuracy: 0.84375, Loss: 0.10076240982658569
Epoch: 461, Accuracy: 0.84375, Loss: 0.10075915211005894
Epoch: 471, Accuracy: 0.84375, Loss: 0.10075618473545582
Epoch: 481, Accuracy: 0.84375, Loss: 0.10075348220426181
Epoch: 491, Accuracy: 0.84375, Loss: 0.1007510214649802

▪ شکل خروجی کد (Accuracy و Loss) مجموعه ارزیابی

Epoch: 11, Accuracy: 0.75, Loss: 0.15820961363576386
Epoch: 21, Accuracy: 0.8020833333333334, Loss: 0.15419787123000586
Epoch: 31, Accuracy: 0.8229166666666666, Loss: 0.1524294270784195
Epoch: 41, Accuracy: 0.8125, Loss: 0.15152460822491823
Epoch: 51, Accuracy: 0.8020833333333334, Loss: 0.15101651276805675
Epoch: 61, Accuracy: 0.7916666666666666, Loss: 0.1507135385419211
Epoch: 71, Accuracy: 0.7916666666666666, Loss: 0.1505263136524574
Epoch: 81, Accuracy: 0.7916666666666666, Loss: 0.1504087718298187
Epoch: 91, Accuracy: 0.7916666666666666, Loss: 0.1503353161737561
Epoch: 101, Accuracy: 0.7916666666666666, Loss: 0.15029087389662232
Epoch: 111, Accuracy: 0.7916666666666666, Loss: 0.15026614335177005
Epoch: 121, Accuracy: 0.78125, Loss: 0.15025515382597396
Epoch: 131, Accuracy: 0.78125, Loss: 0.15025394039058956
Epoch: 141, Accuracy: 0.78125, Loss: 0.1502597907595541
Epoch: 151, Accuracy: 0.7708333333333334, Loss: 0.15027080051265615
Epoch: 161, Accuracy: 0.7708333333333334, Loss: 0.1502856015162154
Epoch: 171, Accuracy: 0.7708333333333334, Loss: 0.15030319108620566
Epoch: 181, Accuracy: 0.78125, Loss: 0.1503228215764298
Epoch: 191, Accuracy: 0.78125, Loss: 0.1503439272222404
Epoch: 201, Accuracy: 0.78125, Loss: 0.15036607454007866
Epoch: 211, Accuracy: 0.78125, Loss: 0.15038892797173758
Epoch: 221, Accuracy: 0.78125, Loss: 0.15041222561137096

▪ نمودار تغییر Loss مجموعه آموزش



▪ نمودار تغییر Accuracy مجموعه آموزش



▪ نمودار تغییر Accuracy مجموعه ارزیابی



○ تعداد لایه=3:

▪ شکل خروجی کد (Accuracy و Loss) مجموعه آموزش

قسمتی از خروجی:

```
poch: 311, Accuracy: 0.9791666666666666, Loss: 0.02270177523051959  
Epoch: 321, Accuracy: 0.9791666666666666, Loss: 0.02227746247064162
```

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Epoch: 331, Accuracy: 0.9791666666666666, Loss: 0.021916083585409
Epoch: 341, Accuracy: 0.9791666666666666, Loss: 0.021604781280528843
Epoch: 351, Accuracy: 0.9817708333333334, Loss: 0.021332766952548907
Epoch: 361, Accuracy: 0.9817708333333334, Loss: 0.021091116189664732
Epoch: 371, Accuracy: 0.9817708333333334, Loss: 0.020872719964195614
Epoch: 381, Accuracy: 0.9817708333333334, Loss: 0.02067217811779452
Epoch: 391, Accuracy: 0.9817708333333334, Loss: 0.020485572598055155
Epoch: 401, Accuracy: 0.9817708333333334, Loss: 0.020310163320490703
Epoch: 411, Accuracy: 0.9791666666666666, Loss: 0.020144076489574374
Epoch: 421, Accuracy: 0.9791666666666666, Loss: 0.01998603462764415
Epoch: 431, Accuracy: 0.9791666666666666, Loss: 0.019835147651801433
Epoch: 441, Accuracy: 0.9791666666666666, Loss: 0.019690763818031348
Epoch: 451, Accuracy: 0.9791666666666666, Loss: 0.01955237023959463
Epoch: 461, Accuracy: 0.9791666666666666, Loss: 0.019419530775017502
Epoch: 471, Accuracy: 0.9791666666666666, Loss: 0.01929185030406088
Epoch: 481, Accuracy: 0.9791666666666666, Loss: 0.019168956519603954
Epoch: 491, Accuracy: 0.9791666666666666, Loss: 0.019050492491190858
Epoch: 501, Accuracy: 0.9791666666666666, Loss: 0.01893611516152313
Epoch: 511, Accuracy: 0.9791666666666666, Loss: 0.01882549655551724
Epoch: 521, Accuracy: 0.9791666666666666, Loss: 0.018718325774386962
Epoch: 531, Accuracy: 0.9791666666666666, Loss: 0.018614310797807898
Epoch: 541, Accuracy: 0.9791666666666666, Loss: 0.018513179748123713
Epoch: 551, Accuracy: 0.9817708333333334, Loss: 0.018414681640461332
Epoch: 561, Accuracy: 0.9817708333333334, Loss: 0.01831858682644792
Epoch: 571, Accuracy: 0.9817708333333334, Loss: 0.01822468740725067
Epoch: 581, Accuracy: 0.9817708333333334, Loss: 0.01813279789718882
Epoch: 591, Accuracy: 0.984375, Loss: 0.01804275639518777
Epoch: 601, Accuracy: 0.984375, Loss: 0.017954426482382997
Epoch: 611, Accuracy: 0.984375, Loss: 0.017867700009476
Epoch: 621, Accuracy: 0.984375, Loss: 0.01778250085333444

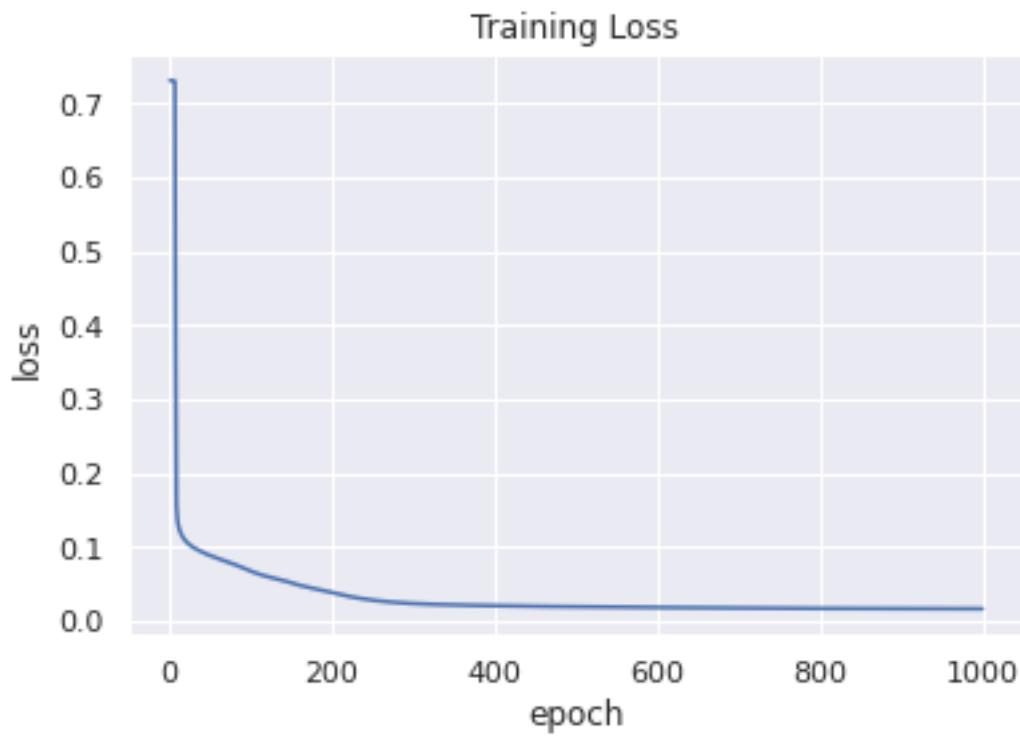
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▪ شکل خروجی کد (Accuracy و Loss) مجموعه ارزیابی

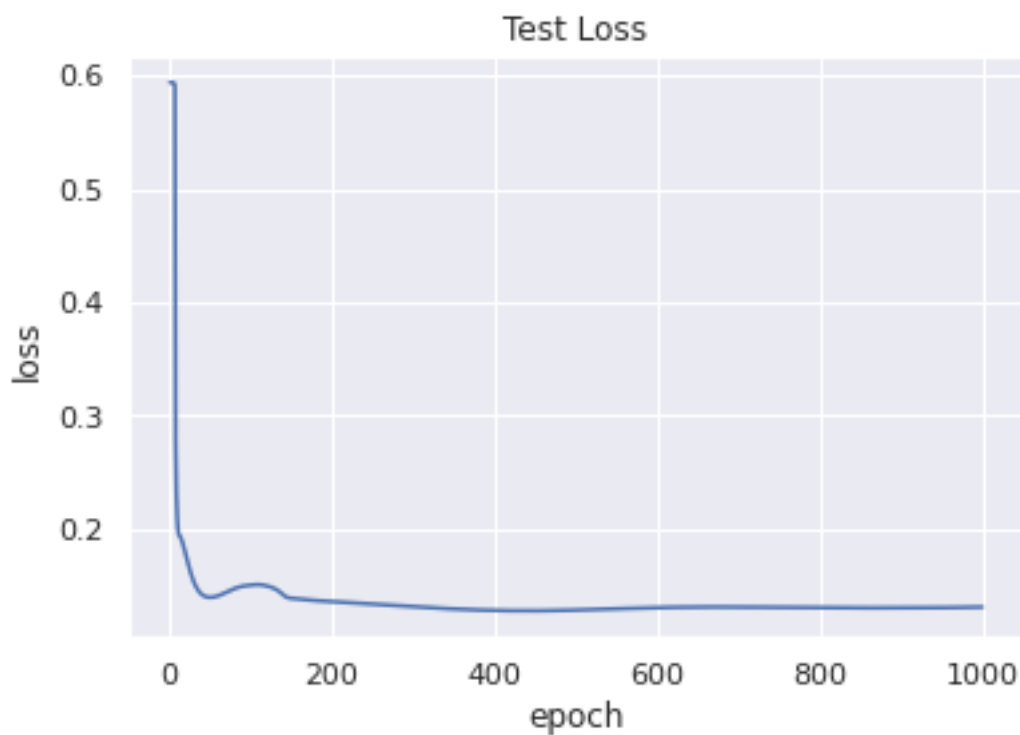
- Epoch: 171, Accuracy: 0.84375, Loss: 0.1379842342359193
- Epoch: 181, Accuracy: 0.84375, Loss: 0.13731739879023583
- Epoch: 191, Accuracy: 0.84375, Loss: 0.13686505398641807
- Epoch: 201, Accuracy: 0.84375, Loss: 0.13619324654409867
- Epoch: 211, Accuracy: 0.84375, Loss: 0.13587182597080974
- Epoch: 221, Accuracy: 0.8333333333333334, Loss: 0.1356921173379005
- Epoch: 231, Accuracy: 0.84375, Loss: 0.13529637147782514
- Epoch: 241, Accuracy: 0.84375, Loss: 0.13481572122597765
- Epoch: 251, Accuracy: 0.8333333333333334, Loss: 0.134304671855641
- Epoch: 261, Accuracy: 0.84375, Loss: 0.13377572777126462
- Epoch: 271, Accuracy: 0.8333333333333334, Loss: 0.13326530919807222
- Epoch: 281, Accuracy: 0.8333333333333334, Loss: 0.1327942840718529
- Epoch: 291, Accuracy: 0.8229166666666666, Loss: 0.13235287364570245
- Epoch: 301, Accuracy: 0.8229166666666666, Loss: 0.13192391515828406
- Epoch: 311, Accuracy: 0.8229166666666666, Loss: 0.13149895295883063
- Epoch: 321, Accuracy: 0.8229166666666666, Loss: 0.1310795542993156
- Epoch: 331, Accuracy: 0.8333333333333334, Loss: 0.1306727824743634

- Epoch: 341, Accuracy: 0.8333333333333334, Loss: 0.13028700094994863
- Epoch: 351, Accuracy: 0.8333333333333334, Loss: 0.12992950184143462
- Epoch: 361, Accuracy: 0.84375, Loss: 0.1296055159009849
- Epoch: 371, Accuracy: 0.84375, Loss: 0.12931806657442133
- Epoch: 381, Accuracy: 0.84375, Loss: 0.12906837973611238

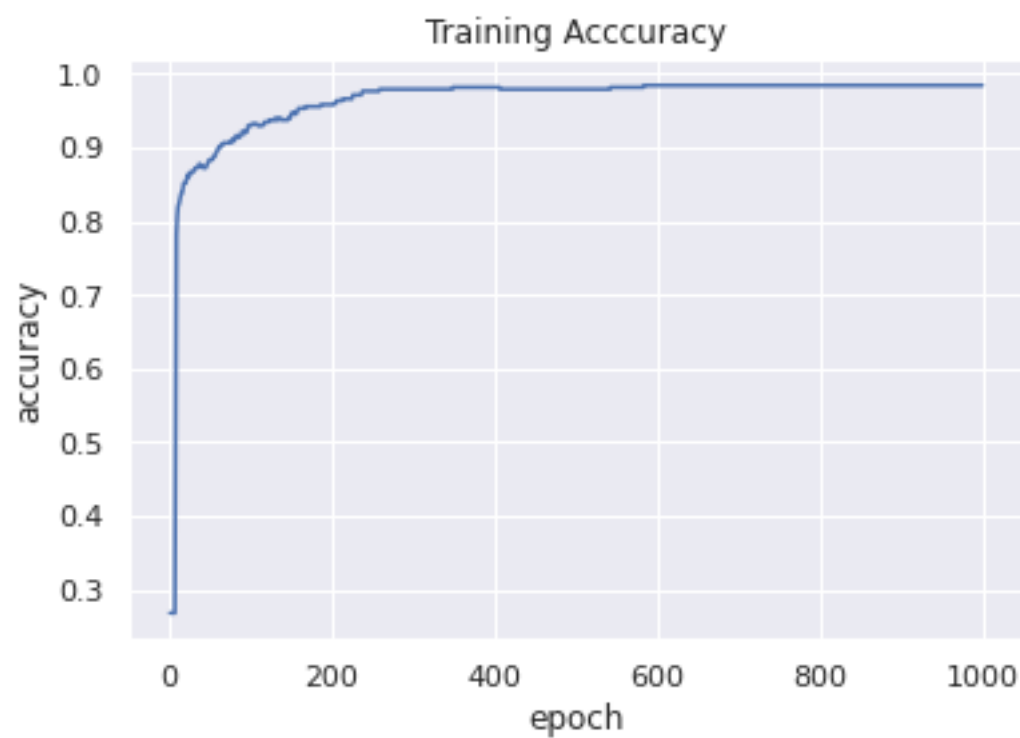
▪ نمودار تغییر Loss مجموعه آموزش



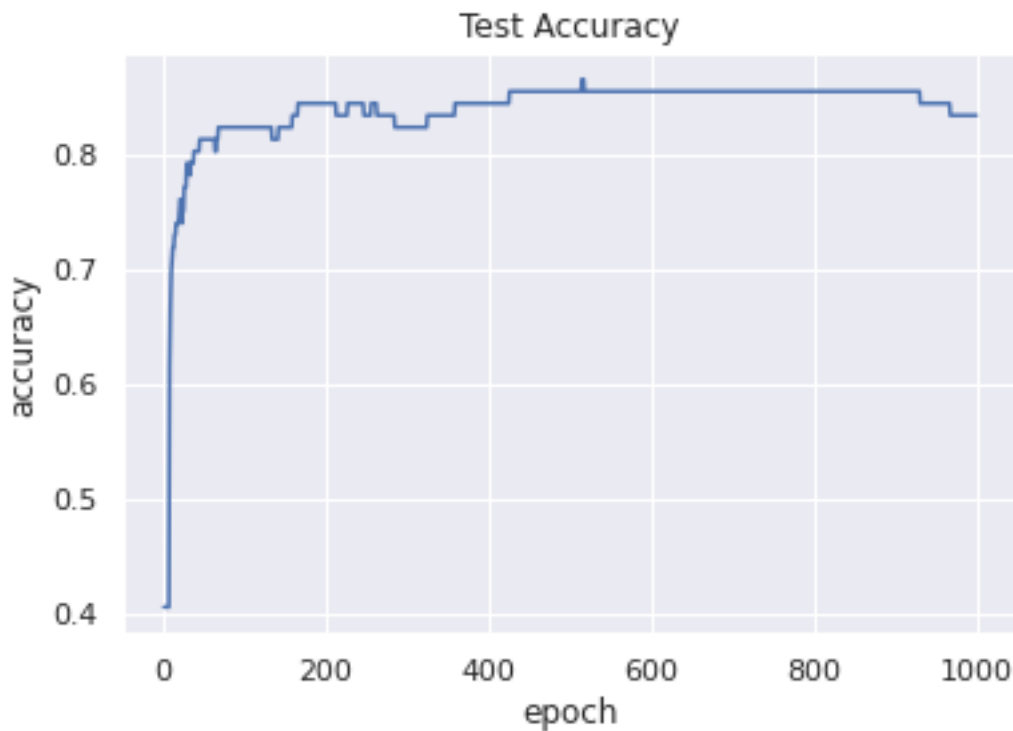
▪ نمودار تغییر Loss مجموعه ارزیابی



▪ نمودار تغییر Accuracy مجموعه آموزش



▪ نمودار تغییر Accuracy مجموعه ارزیابی



○ تعداد لایه=5:

▪ شکل خروجی کد (Accuracy و Loss) مجموعه آموزش

- Epoch: 501, Accuracy: 0.9244791666666666, Loss: 0.054984416181368574
- Epoch: 511, Accuracy: 0.90625, Loss: 0.06879616759807872
- Epoch: 521, Accuracy: 0.9296875, Loss: 0.05173074068945491
- Epoch: 531, Accuracy: 0.9166666666666666, Loss: 0.05978763660086877
- Epoch: 541, Accuracy: 0.9270833333333334, Loss: 0.05714694954329343
- Epoch: 551, Accuracy: 0.9401041666666666, Loss: 0.046656314143521456
- Epoch: 561, Accuracy: 0.9479166666666666, Loss: 0.04394001711426049
- Epoch: 571, Accuracy: 0.9505208333333334, Loss: 0.04319235203936355
- Epoch: 581, Accuracy: 0.9427083333333334, Loss: 0.046815425332956496
- Epoch: 591, Accuracy: 0.9609375, Loss: 0.039749634060622256
- Epoch: 601, Accuracy: 0.9661458333333334, Loss: 0.03681074305782366
- Epoch: 611, Accuracy: 0.9401041666666666, Loss: 0.04527510886138975
- Epoch: 621, Accuracy: 0.9635416666666666, Loss: 0.0364909717361498
- Epoch: 631, Accuracy: 0.9661458333333334, Loss: 0.034688208742638844
- Epoch: 641, Accuracy: 0.9713541666666666, Loss: 0.03126641438345111
- Epoch: 651, Accuracy: 0.9713541666666666, Loss: 0.030257885930631084

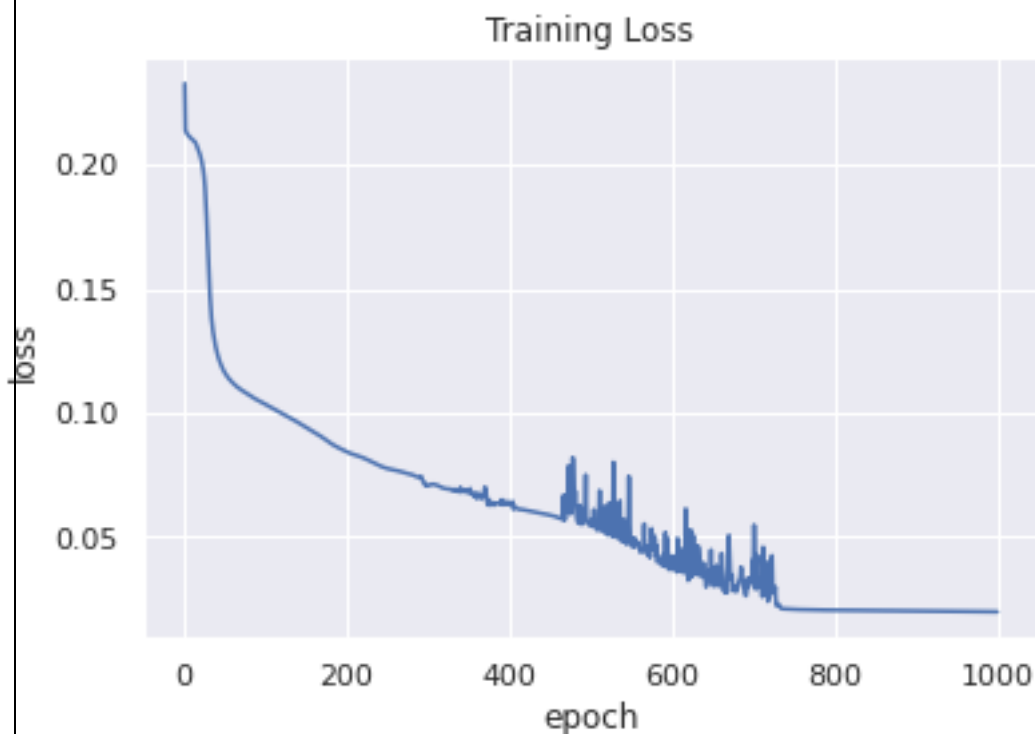
- Epoch: 661, Accuracy: 0.9479166666666666, Loss: 0.0434709713917587
- Epoch: 671, Accuracy: 0.9505208333333334, Loss: 0.04231305220813087
- Epoch: 681, Accuracy: 0.96875, Loss: 0.029652371052950016
- Epoch: 691, Accuracy: 0.9765625, Loss: 0.0264047916464561
- Epoch: 701, Accuracy: 0.9270833333333334, Loss: 0.05488771207725735
- Epoch: 711, Accuracy: 0.9713541666666666, Loss: 0.026015327544766632
- Epoch: 721, Accuracy: 0.96875, Loss: 0.027908252280832473
- Epoch: 731, Accuracy: 0.9765625, Loss: 0.023068903502080285
- Epoch: 741, Accuracy: 0.9791666666666666, Loss: 0.02107153766761303

▪ شکل خروجی کد (Accuracy و Loss) مجموعه ارزیابی

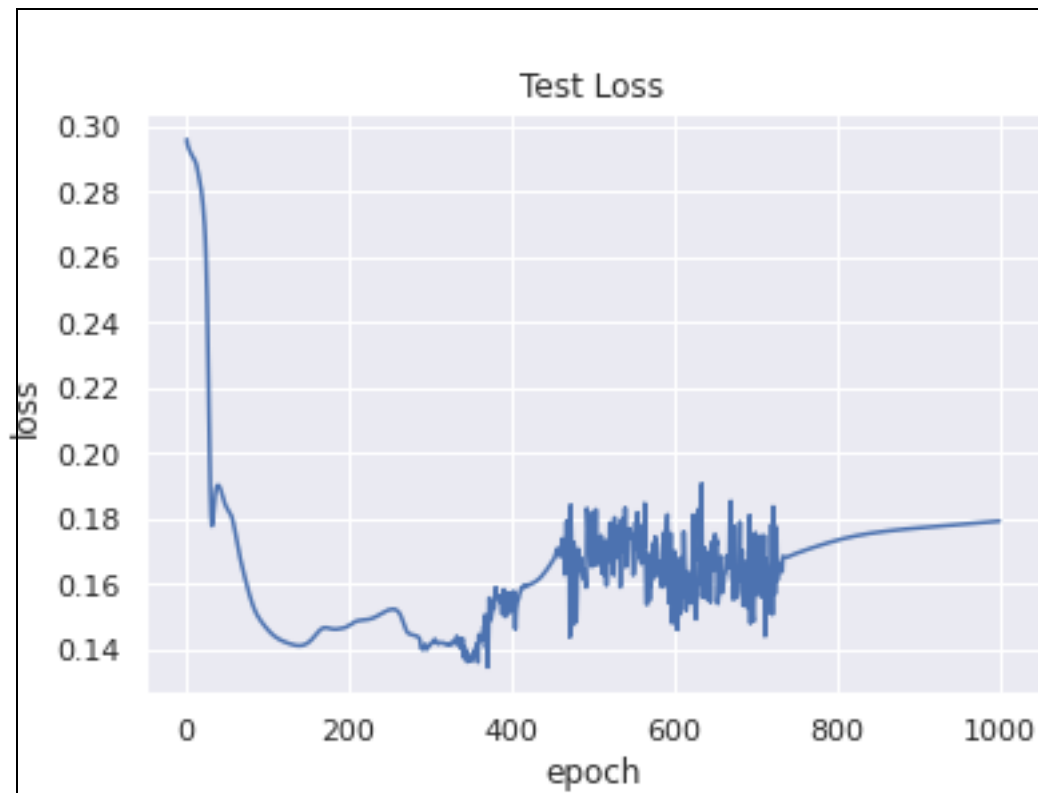
- Epoch: 551, Accuracy: 0.8125, Loss: 0.16436326467578452
- Epoch: 561, Accuracy: 0.78125, Loss: 0.17401007289092757
- Epoch: 571, Accuracy: 0.8020833333333334, Loss: 0.1635237162420699
- Epoch: 581, Accuracy: 0.7916666666666666, Loss: 0.1626801750307288
- Epoch: 591, Accuracy: 0.78125, Loss: 0.17535834414474363
- Epoch: 601, Accuracy: 0.7916666666666666, Loss: 0.17000599675891473
- Epoch: 611, Accuracy: 0.8125, Loss: 0.15633588084443092
- Epoch: 621, Accuracy: 0.8020833333333334, Loss: 0.1557347120948192
- Epoch: 631, Accuracy: 0.7916666666666666, Loss: 0.18299549258007022
- Epoch: 641, Accuracy: 0.8020833333333334, Loss: 0.1553244587689757
- Epoch: 651, Accuracy: 0.8020833333333334, Loss: 0.17495765650714645
- Epoch: 661, Accuracy: 0.8229166666666666, Loss: 0.15957628551576927
- Epoch: 671, Accuracy: 0.8229166666666666, Loss: 0.16199080945399752
- Epoch: 681, Accuracy: 0.7708333333333334, Loss: 0.17896446628201154
- Epoch: 691, Accuracy: 0.8229166666666666, Loss: 0.15257122875825416
- Epoch: 701, Accuracy: 0.8125, Loss: 0.1566356435329135
- Epoch: 711, Accuracy: 0.8020833333333334, Loss: 0.1748336200947833
- Epoch: 721, Accuracy: 0.8333333333333334, Loss: 0.15064238181010364
- Epoch: 731, Accuracy: 0.8020833333333334, Loss: 0.16598069992275288
- Epoch: 741, Accuracy: 0.8125, Loss: 0.16837577233881415
- Epoch: 751, Accuracy: 0.8125, Loss: 0.16941926069890662
- Epoch: 761, Accuracy: 0.8125, Loss: 0.17030410931223924
- Epoch: 771, Accuracy: 0.8020833333333334, Loss: 0.1711403552167192

- Epoch: 781, Accuracy: 0.8020833333333334, Loss: 0.17194557815115075
- Epoch: 791, Accuracy: 0.8020833333333334, Loss: 0.17270680677225317
- Epoch: 801, Accuracy: 0.8020833333333334, Loss: 0.17340562259952427
- Epoch: 811, Accuracy: 0.8020833333333334, Loss: 0.1740304022718796
- Epoch: 821, Accuracy: 0.8020833333333334, Loss: 0.17457876001233258
- Epoch: 831, Accuracy: 0.8020833333333334, Loss: 0.17505550950999935
- Epoch: 841, Accuracy: 0.8020833333333334, Loss: 0.17546944676825
- Epoch: 851, Accuracy: 0.8020833333333334, Loss: 0.1758306393060933
- Epoch: 861, Accuracy: 0.8020833333333334, Loss: 0.1761487953084338
- Epoch: 871, Accuracy: 0.8020833333333334, Loss: 0.17643258319927405
- Epoch: 881, Accuracy: 0.7916666666666666, Loss: 0.17668952714482677
- Epoch: 891, Accuracy: 0.7916666666666666, Loss: 0.17692613468860352
- Epoch: 901, Accuracy: 0.7916666666666666, Loss: 0.17714799815968282

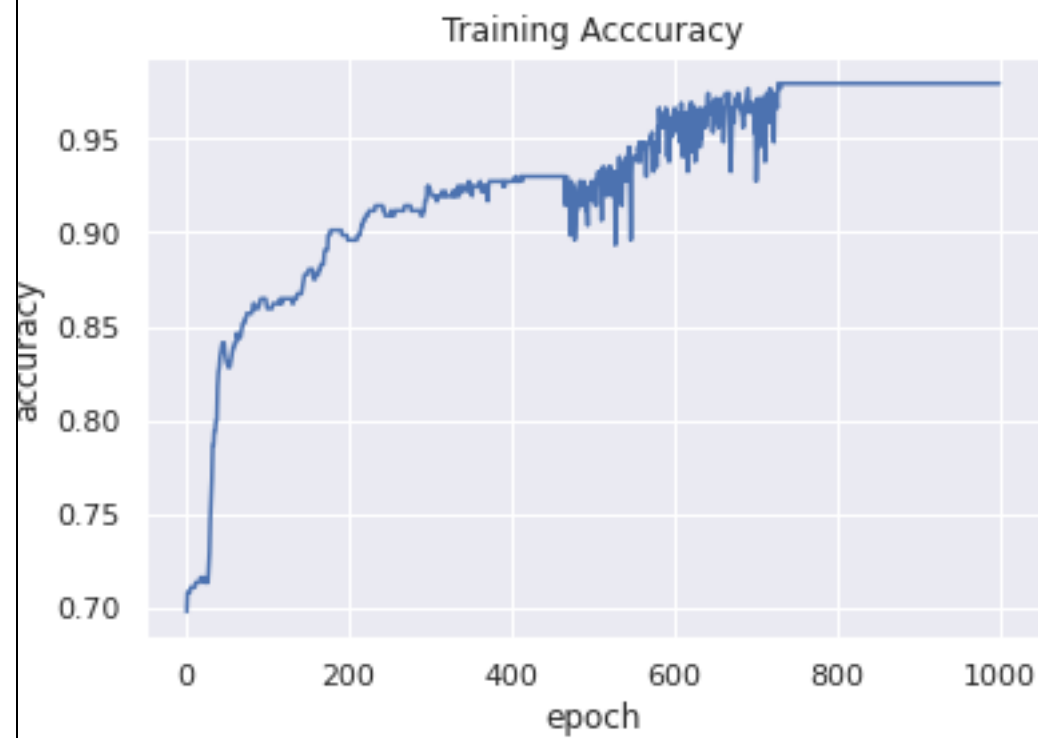
▪ نمودار تغییر Loss مجموعه آموزش



▪ نمودار تغییر Loss مجموعه ارزیابی

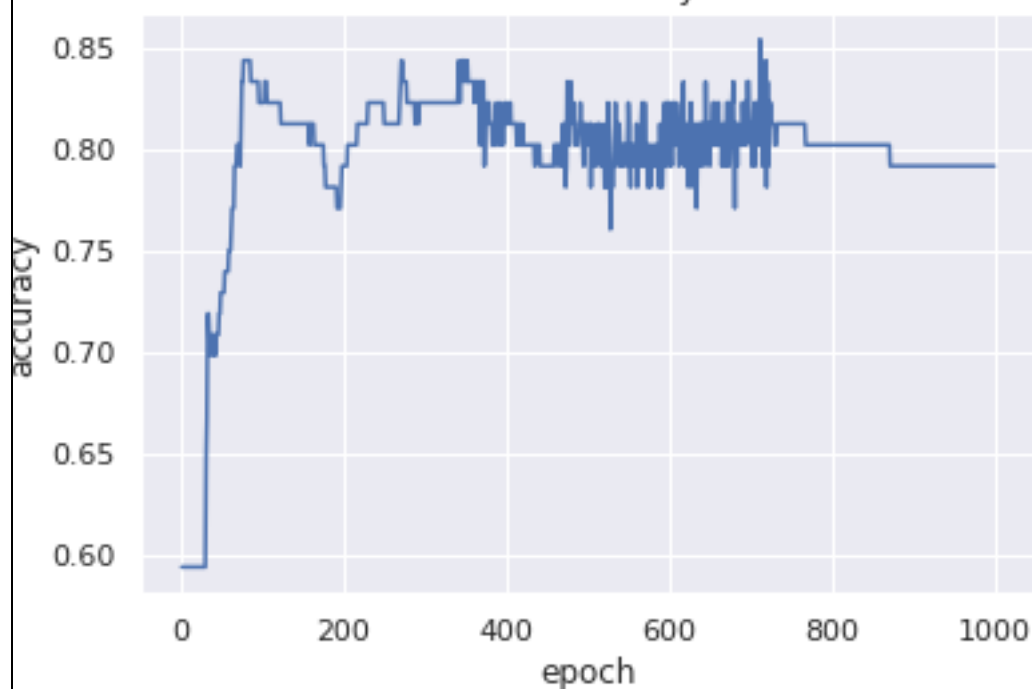


▪ نمودار تغییر Accuracy مجموعه آموزشی



▪ نمودار تغییر Accuracy مجموعه ارزیابی

Test Accuracy



• نتایج به ازای مقداردهی اولیه صفر

مقدار α و k : 0.1 و 1000				
تعداد لایه	Loss و Accuracy بهترین مدل (بر اساس کمترین Loss) - مجموعه آموزش	Loss و Accuracy بهترین مدل (بر اساس کمترین Loss) - مجموعه ارزیابی	Loss و Accuracy بهترین مدل (بر اساس بیشترین Accuracy) - مجموعه آموزش	Loss و Accuracy بهترین مدل (بر اساس بیشترین Accuracy) - مجموعه ارزیابی
2	Acc: 0.8489583333333334, Loss: 0.10072961736565005	Acc: 0.78125, Loss: 0.1502544703182929	Acc: 0.8229166666666666, Loss: 0.15206235428498807	Acc: 0.8515625, Loss: 0.10073059923364946
3	Acc: 0.7395833333333334, Loss: 0.12077332551844806	Acc: 0.59375, Loss: 0.17846689644747746	Acc: 0.59375, Loss: 0.28924477928421755	Acc: 0.7395833333333334, Loss: 0.12077332551844806
5	Acc: 0.7317708333333334, Loss: 0.141262143753277	Acc: 0.59375, Loss: 0.18949264873881788	Acc: 0.59375, Loss: 0.18949264873881788	Acc: 0.7317708333333334, Loss: 0.20356923906586807

○ تعداد لایه=2:

▪ شکل خروجی کد (Accuracy و Loss) مجموعه آموزش

- Epoch: 691, Accuracy: 0.8463541666666666, Loss: 0.10073072174368618
- Epoch: 701, Accuracy: 0.8463541666666666, Loss: 0.10073047922265009
- Epoch: 711, Accuracy: 0.8463541666666666, Loss: 0.10073027313823206

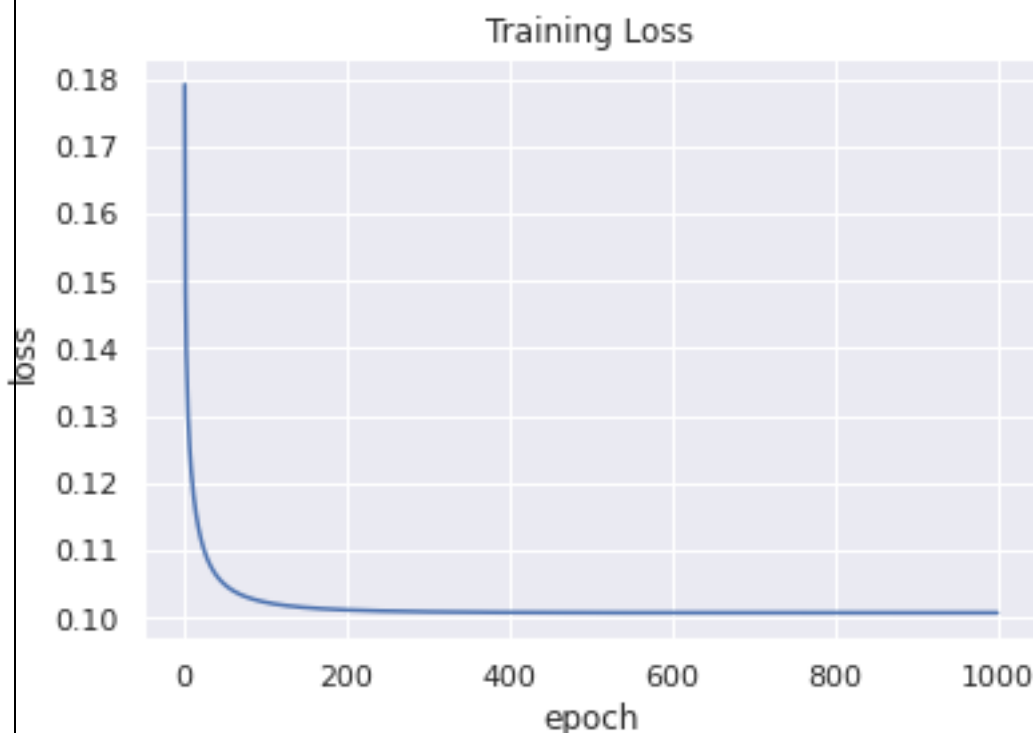
- Epoch: 721, Accuracy: 0.8463541666666666, Loss: 0.10073010045967054
- Epoch: 731, Accuracy: 0.8463541666666666, Loss: 0.10072995839199912
- Epoch: 741, Accuracy: 0.8463541666666666, Loss: 0.10072984435686491
- Epoch: 751, Accuracy: 0.8463541666666666, Loss: 0.10072975597504402
- Epoch: 761, Accuracy: 0.8489583333333334, Loss: 0.10072969105049497
- Epoch: 771, Accuracy: 0.8489583333333334, Loss: 0.10072964755579458
- Epoch: 781, Accuracy: 0.8489583333333334, Loss: 0.10072962361883002
- Epoch: 791, Accuracy: 0.8489583333333334, Loss: 0.10072961751062244
- Epoch: 801, Accuracy: 0.8489583333333334, Loss: 0.10072962763418097
- Epoch: 811, Accuracy: 0.8489583333333334, Loss: 0.10072965251428802
- Epoch: 821, Accuracy: 0.8489583333333334, Loss: 0.1007296907881325
- Epoch: 831, Accuracy: 0.8489583333333334, Loss: 0.10072974119671338
- Epoch: 841, Accuracy: 0.8489583333333334, Loss: 0.10072980257694471
- Epoch: 851, Accuracy: 0.8489583333333334, Loss: 0.10072987385439738
- Epoch: 861, Accuracy: 0.8489583333333334, Loss: 0.1007299540366257
- Epoch: 871, Accuracy: 0.8489583333333334, Loss: 0.10073004220702425
- Epoch: 881, Accuracy: 0.8489583333333334, Loss: 0.10073013751916955
- Epoch: 891, Accuracy: 0.8489583333333334, Loss: 0.10073023919160672
- Epoch: 901, Accuracy: 0.8489583333333334, Loss: 0.10073034650304166
- Epoch: 911, Accuracy: 0.8489583333333334, Loss: 0.10073045878790518
- Epoch: 921, Accuracy: 0.8489583333333334, Loss: 0.10073057543225801
- Epoch: 931, Accuracy: 0.8515625, Loss: 0.10073069587000842
- Epoch: 941, Accuracy: 0.8515625, Loss: 0.10073081957941672
- Epoch: 951, Accuracy: 0.8515625, Loss: 0.10073094607986331
- Epoch: 961, Accuracy: 0.8515625, Loss: 0.10073107492885852
- Epoch: 971, Accuracy: 0.8515625, Loss: 0.10073120571927649
- Epoch: 981, Accuracy: 0.8515625, Loss: 0.10073133807679287
- Epoch: 991, Accuracy: 0.8515625, Loss: 0.10073147165751162

▪ شکل خروجی کد (Accuracy و Loss) مجموعه ارزیابی

- Epoch: 721, Accuracy: 0.78125, Loss: 0.15115763929268566
- Epoch: 731, Accuracy: 0.78125, Loss: 0.1511645172136656
- Epoch: 741, Accuracy: 0.78125, Loss: 0.15117120084036276
- Epoch: 751, Accuracy: 0.78125, Loss: 0.1511776958037029

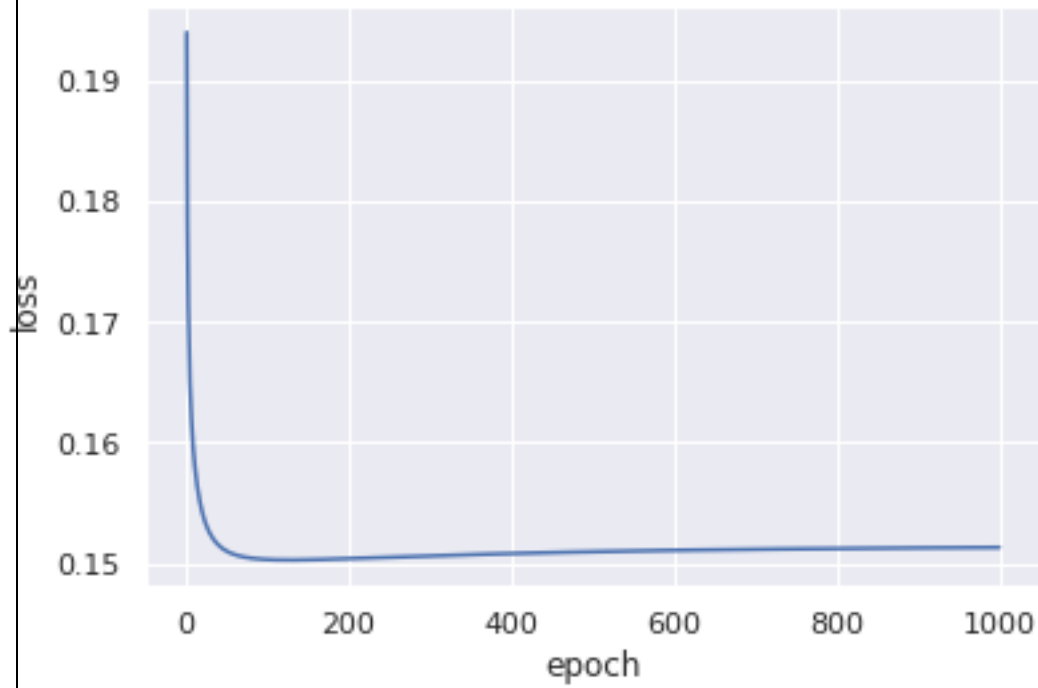
- Epoch: 761, Accuracy: 0.78125, Loss: 0.15118400757163458
- Epoch: 771, Accuracy: 0.78125, Loss: 0.15119014145308757
- Epoch: 781, Accuracy: 0.78125, Loss: 0.1511961026019566
- Epoch: 791, Accuracy: 0.78125, Loss: 0.15120189602109635
- Epoch: 801, Accuracy: 0.78125, Loss: 0.1512075265663053
- Epoch: 811, Accuracy: 0.78125, Loss: 0.15121299895028803
- Epoch: 821, Accuracy: 0.78125, Loss: 0.15121831774657532
- Epoch: 831, Accuracy: 0.78125, Loss: 0.15122348739340188
- Epoch: 841, Accuracy: 0.78125, Loss: 0.15122851219752273
- Epoch: 851, Accuracy: 0.78125, Loss: 0.15123339633797359
- Epoch: 861, Accuracy: 0.78125, Loss: 0.15123814386975037
- Epoch: 871, Accuracy: 0.78125, Loss: 0.15124275872742793
- Epoch: 881, Accuracy: 0.78125, Loss: 0.15124724472869155
- Epoch: 891, Accuracy: 0.78125, Loss: 0.1512516055777938
- Epoch: 901, Accuracy: 0.78125, Loss: 0.15125584486892654
- Epoch: 911, Accuracy: 0.78125, Loss: 0.15125996608951284
- Epoch: 921, Accuracy: 0.78125, Loss: 0.15126397262341096
- Epoch: 931, Accuracy: 0.78125, Loss: 0.15126786775403747
- Epoch: 941, Accuracy: 0.78125, Loss: 0.15127165466740464
- Epoch: 951, Accuracy: 0.78125, Loss: 0.1512753364550742
- Epoch: 961, Accuracy: 0.78125, Loss: 0.15127891611702762
- Epoch: 971, Accuracy: 0.78125, Loss: 0.15128239656445722
- Epoch: 981, Accuracy: 0.78125, Loss: 0.15128578062247142
- Epoch: 991, Accuracy: 0.78125, Loss: 0.15128907103272732

▪ نمودار تغییر Loss مجموعه آموزش



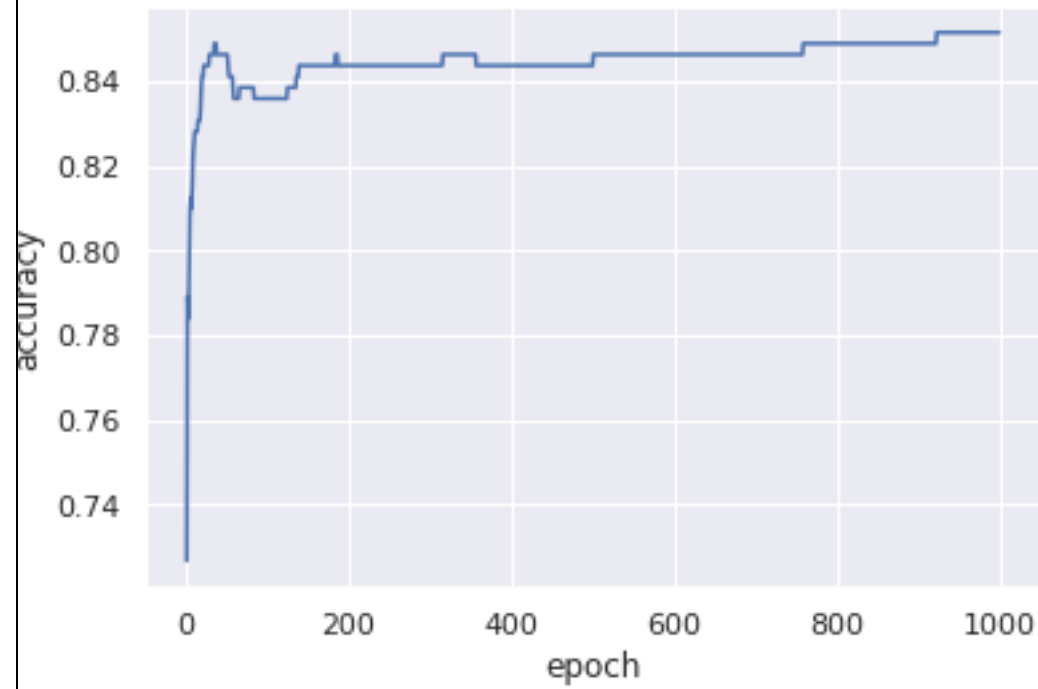
▪ نمودار تغییر Loss مجموعه ارزیابی

Test Loss



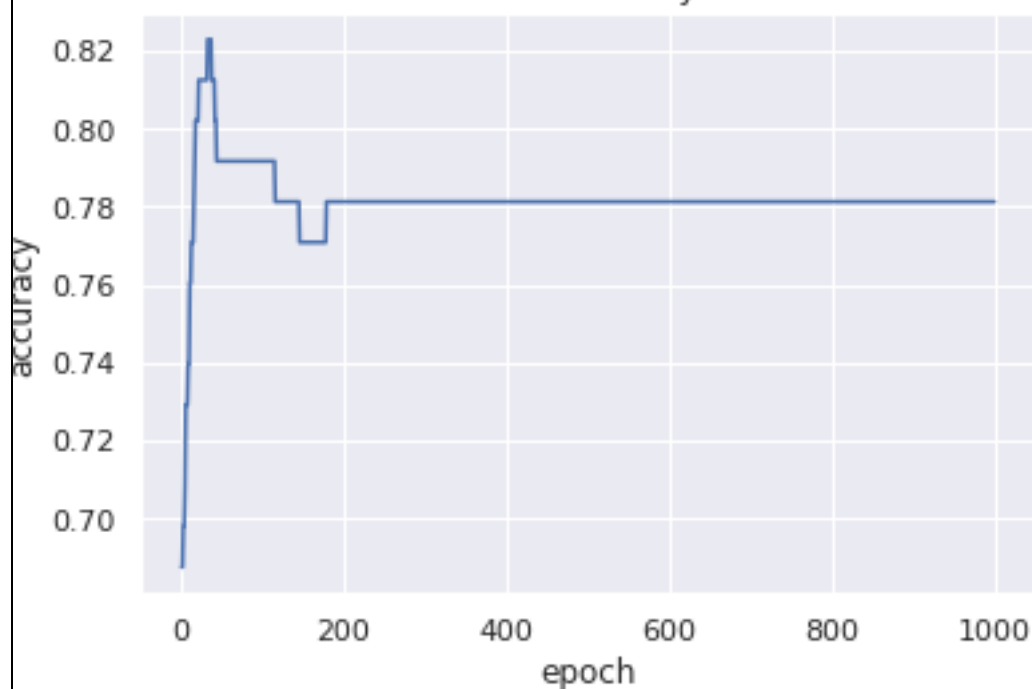
▪ نمودار تغییر Accuracy مجموعه آموزش

Training Accuracy



▪ نمودار تغییر Accuracy مجموعه ارزیابی

Test Accuracy



○ تعداد لایه=3:

▪ شکل خروجی کد (Accuracy و Loss) مجموعه آموزش

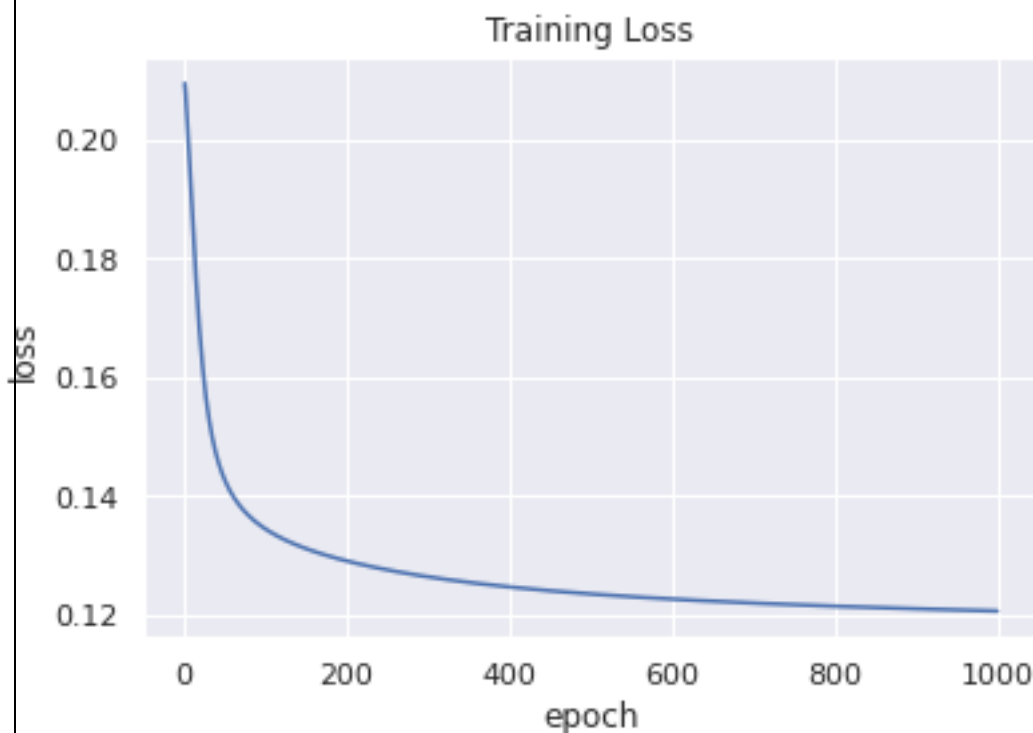
```
Epoch: 711, Accuracy: 0.7395833333333334, Loss: 0.12203949839152438
Epoch: 721, Accuracy: 0.7395833333333334, Loss: 0.12198276833513397
Epoch: 731, Accuracy: 0.7395833333333334, Loss: 0.12192726315723462
Epoch: 741, Accuracy: 0.7395833333333334, Loss: 0.1218729393746063
Epoch: 751, Accuracy: 0.7395833333333334, Loss: 0.12181975551740482
Epoch: 761, Accuracy: 0.7395833333333334, Loss: 0.12176767201658717
Epoch: 771, Accuracy: 0.7395833333333334, Loss: 0.12171665109847657
Epoch: 781, Accuracy: 0.7395833333333334, Loss: 0.12166665668597706
Epoch: 791, Accuracy: 0.7395833333333334, Loss: 0.12161765430598523
Epoch: 801, Accuracy: 0.7395833333333334, Loss: 0.12156961100257527
Epoch: 811, Accuracy: 0.7395833333333334, Loss: 0.12152249525556474
Epoch: 821, Accuracy: 0.7395833333333334, Loss: 0.12147627690409735
Epoch: 831, Accuracy: 0.7395833333333334, Loss: 0.12143092707490488
Epoch: 841, Accuracy: 0.7395833333333334, Loss: 0.12138641811493003
Epoch: 851, Accuracy: 0.7395833333333334, Loss: 0.12134272352802182
Epoch: 861, Accuracy: 0.7421875, Loss: 0.12129981791543
Epoch: 871, Accuracy: 0.7421875, Loss: 0.12125767691984608
Epoch: 881, Accuracy: 0.7421875, Loss: 0.12121627717275704
Epoch: 891, Accuracy: 0.7421875, Loss: 0.12117559624489399
Epoch: 901, Accuracy: 0.7421875, Loss: 0.12113561259957284
Epoch: 911, Accuracy: 0.7421875, Loss: 0.12109630554873807
Epoch: 921, Accuracy: 0.7395833333333334, Loss: 0.12105765521153669
Epoch: 931, Accuracy: 0.7395833333333334, Loss: 0.12101964247525714
Epoch: 941, Accuracy: 0.7395833333333334, Loss: 0.12098224895848336
Epoch: 951, Accuracy: 0.7395833333333334, Loss: 0.12094545697632247
Epoch: 961, Accuracy: 0.7395833333333334, Loss: 0.12090924950757509
Epoch: 971, Accuracy: 0.7395833333333334, Loss: 0.12087361016372516
Epoch: 981, Accuracy: 0.7395833333333334, Loss: 0.12083852315963813
Epoch: 991, Accuracy: 0.7395833333333334, Loss: 0.12080397328585817
```

▪ شکل خروجی کد (Accuracy و Loss) مجموعه ارزیابی

- Epoch: 771, Accuracy: 0.59375, Loss: 0.17873953187426536

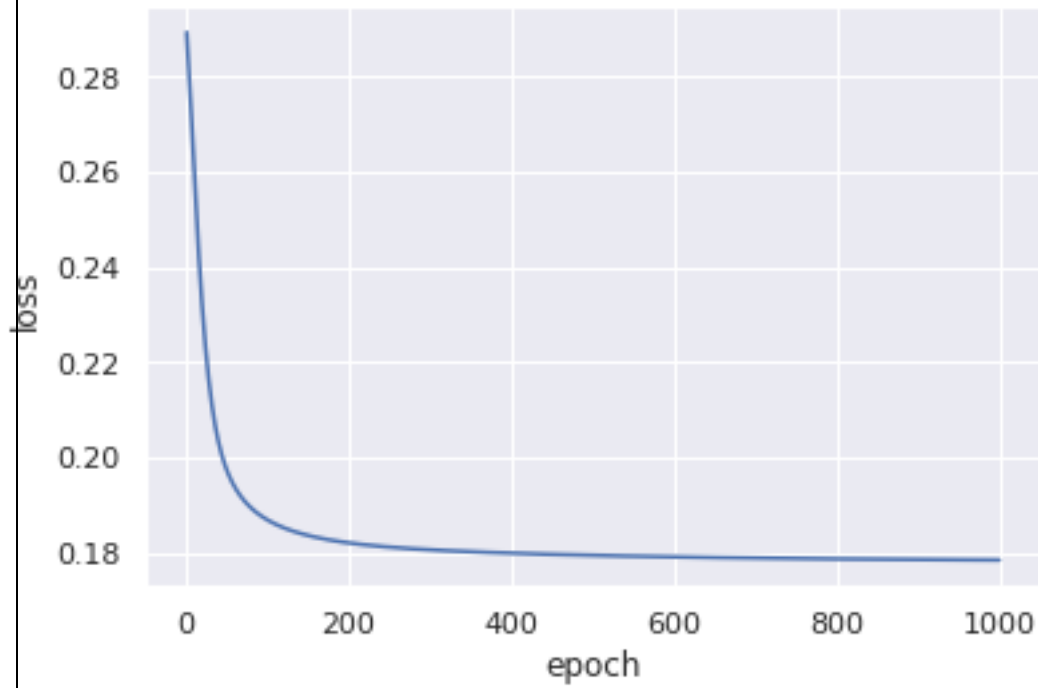
- Epoch: 781, Accuracy: 0.59375, Loss: 0.17872291772763182
- Epoch: 791, Accuracy: 0.59375, Loss: 0.1787068008559876
- Epoch: 801, Accuracy: 0.59375, Loss: 0.17869117008972366
- Epoch: 811, Accuracy: 0.59375, Loss: 0.1786760146247816
- Epoch: 821, Accuracy: 0.59375, Loss: 0.17866132400224202
- Epoch: 831, Accuracy: 0.59375, Loss: 0.17864708808975946
- Epoch: 841, Accuracy: 0.59375, Loss: 0.17863329706462638
- Epoch: 851, Accuracy: 0.59375, Loss: 0.1786199413982801
- Epoch: 861, Accuracy: 0.59375, Loss: 0.1786070118420864
- Epoch: 871, Accuracy: 0.59375, Loss: 0.1785944994142608
- Epoch: 881, Accuracy: 0.59375, Loss: 0.17858239538779014
- Epoch: 891, Accuracy: 0.59375, Loss: 0.1785706912792602
- Epoch: 901, Accuracy: 0.59375, Loss: 0.17855937883847514
- Epoch: 911, Accuracy: 0.59375, Loss: 0.17854845003879471
- Epoch: 921, Accuracy: 0.59375, Loss: 0.17853789706811157
- Epoch: 931, Accuracy: 0.59375, Loss: 0.17852771232039952
- Epoch: 941, Accuracy: 0.59375, Loss: 0.17851788838778002
- Epoch: 951, Accuracy: 0.59375, Loss: 0.1785084180530495
- Epoch: 961, Accuracy: 0.59375, Loss: 0.1784992942826307
- Epoch: 971, Accuracy: 0.59375, Loss: 0.17849051021990076
- Epoch: 981, Accuracy: 0.59375, Loss: 0.17848205917886484
- Epoch: 991, Accuracy: 0.59375, Loss: 0.1784739346381451

▪ نمودار تغییر Loss مجموعه آموزش



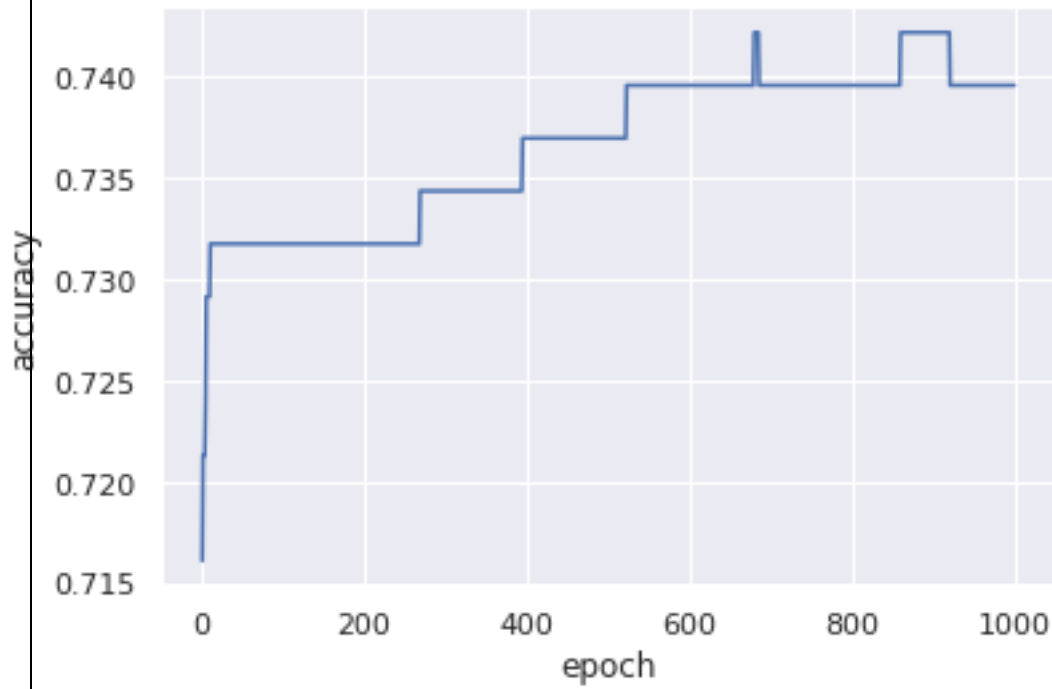
▪ نمودار تغییر Loss مجموعه ارزیابی

Test Loss



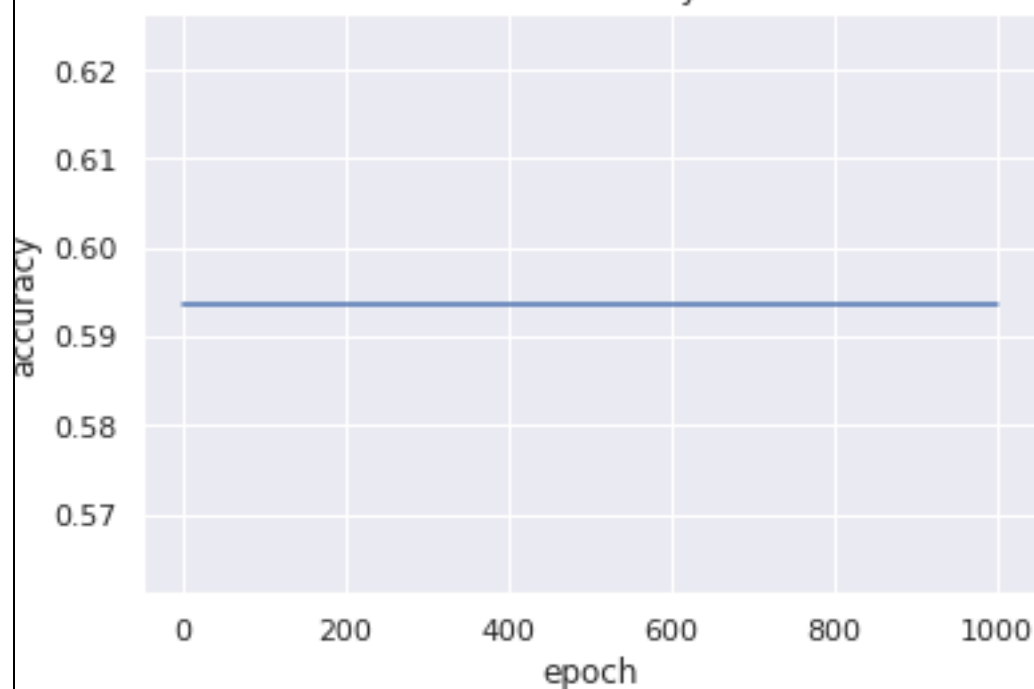
▪ نمودار تغییر Accuracy مجموعه آموزشی

Training Accuracy



▪ نمودار تغییر Accuracy مجموعه ارزیابی

Test Accuracy



○ تعداد لایه=5:

▪ شکل خروجی کد (Accuracy و Loss) مجموعه آموزش

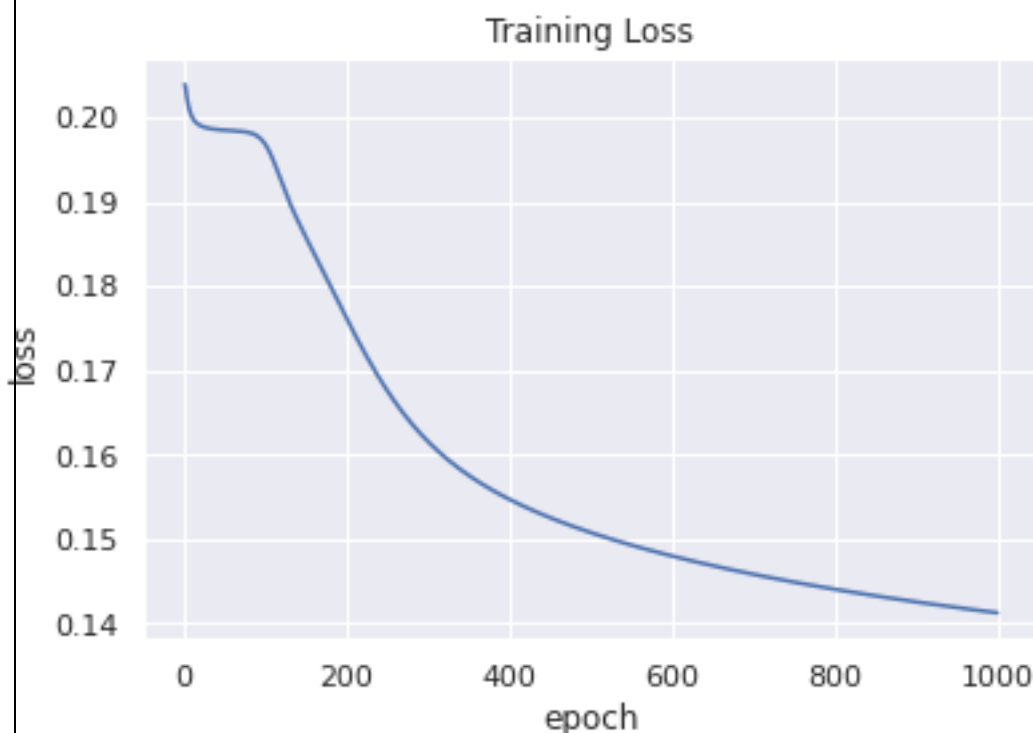
```
Epoch: 721, Accuracy: 0.7317708333333334, Loss: 0.14542476022733453
Epoch: 731, Accuracy: 0.7317708333333334, Loss: 0.14523964496632982
Epoch: 741, Accuracy: 0.7317708333333334, Loss: 0.14505797512947033
Epoch: 751, Accuracy: 0.7317708333333334, Loss: 0.14487963314087302
Epoch: 761, Accuracy: 0.7317708333333334, Loss: 0.14470450754470282
Epoch: 771, Accuracy: 0.7317708333333334, Loss: 0.14453249251376185
Epoch: 781, Accuracy: 0.7317708333333334, Loss: 0.14436348741097807
Epoch: 791, Accuracy: 0.7317708333333334, Loss: 0.14419739639767182
Epoch: 801, Accuracy: 0.7317708333333334, Loss: 0.14403412808314356
Epoch: 811, Accuracy: 0.7317708333333334, Loss: 0.14387359521071874
Epoch: 821, Accuracy: 0.7317708333333334, Loss: 0.14371571437593195
Epoch: 831, Accuracy: 0.7317708333333334, Loss: 0.14356040577300208
Epoch: 841, Accuracy: 0.7317708333333334, Loss: 0.14340759296621525
Epoch: 851, Accuracy: 0.7317708333333334, Loss: 0.14325720268319653
Epoch: 861, Accuracy: 0.7317708333333334, Loss: 0.1431091646274367
Epoch: 871, Accuracy: 0.7317708333333334, Loss: 0.14296341130774365
Epoch: 881, Accuracy: 0.7317708333333334, Loss: 0.14281987788258166
Epoch: 891, Accuracy: 0.7317708333333334, Loss: 0.1426785020175196
Epoch: 901, Accuracy: 0.7317708333333334, Loss: 0.1425392237542354
Epoch: 911, Accuracy: 0.7317708333333334, Loss: 0.14240198538972504
Epoch: 921, Accuracy: 0.7317708333333334, Loss: 0.1422667313645493
Epoch: 931, Accuracy: 0.7317708333333334, Loss: 0.14213340815910094
Epoch: 941, Accuracy: 0.7317708333333334, Loss: 0.14200196419701316
Epoch: 951, Accuracy: 0.7317708333333334, Loss: 0.14187234975496005
Epoch: 961, Accuracy: 0.7317708333333334, Loss: 0.1417445168781834
Epoch: 971, Accuracy: 0.7317708333333334, Loss: 0.14161841930118996
Epoch: 981, Accuracy: 0.7317708333333334, Loss: 0.1414940123731266
Epoch: 991, Accuracy: 0.7317708333333334, Loss: 0.14137125298741296
```

▪ شکل خروجی کد (Accuracy و Loss) مجموعه ارزیابی

- Epoch: 741, Accuracy: 0.59375, Loss: 0.19256740607240425
- Epoch: 751, Accuracy: 0.59375, Loss: 0.19240124116080165

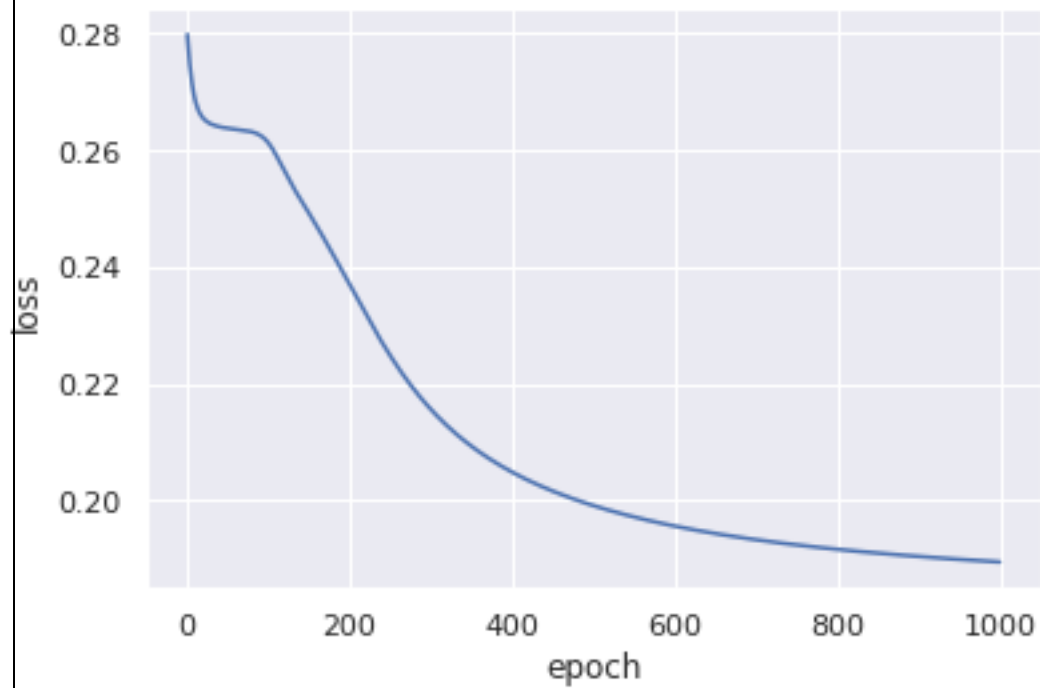
- Epoch: 761, Accuracy: 0.59375, Loss: 0.19224032653367018
- Epoch: 771, Accuracy: 0.59375, Loss: 0.19208442268010584
- Epoch: 781, Accuracy: 0.59375, Loss: 0.19193330341457357
- Epoch: 791, Accuracy: 0.59375, Loss: 0.19178675500156292
- Epoch: 801, Accuracy: 0.59375, Loss: 0.19164457534390708
- Epoch: 811, Accuracy: 0.59375, Loss: 0.19150657322956638
- Epoch: 821, Accuracy: 0.59375, Loss: 0.19137256763225668
- Epoch: 831, Accuracy: 0.59375, Loss: 0.19124238706177638
- Epoch: 841, Accuracy: 0.59375, Loss: 0.19111586896028906
- Epoch: 851, Accuracy: 0.59375, Loss: 0.19099285914116002
- Epoch: 861, Accuracy: 0.59375, Loss: 0.19087321126723303
- Epoch: 871, Accuracy: 0.59375, Loss: 0.19075678636568752
- Epoch: 881, Accuracy: 0.59375, Loss: 0.19064345237683822
- Epoch: 891, Accuracy: 0.59375, Loss: 0.19053308373442646
- Epoch: 901, Accuracy: 0.59375, Loss: 0.19042556097514168
- Epoch: 911, Accuracy: 0.59375, Loss: 0.1903207703752546
- Epoch: 921, Accuracy: 0.59375, Loss: 0.19021860361239948
- Epoch: 931, Accuracy: 0.59375, Loss: 0.19011895745067647
- Epoch: 941, Accuracy: 0.59375, Loss: 0.1900217334473642
- Epoch: 951, Accuracy: 0.59375, Loss: 0.18992683767965668
- Epoch: 961, Accuracy: 0.59375, Loss: 0.1898341804899463
- Epoch: 971, Accuracy: 0.59375, Loss: 0.18974367624827293
- Epoch: 981, Accuracy: 0.59375, Loss: 0.1896552431306676
- Epoch: 991, Accuracy: 0.59375, Loss: 0.18956880291219944

▪ نمودار تغییر Loss مجموعه آموزش



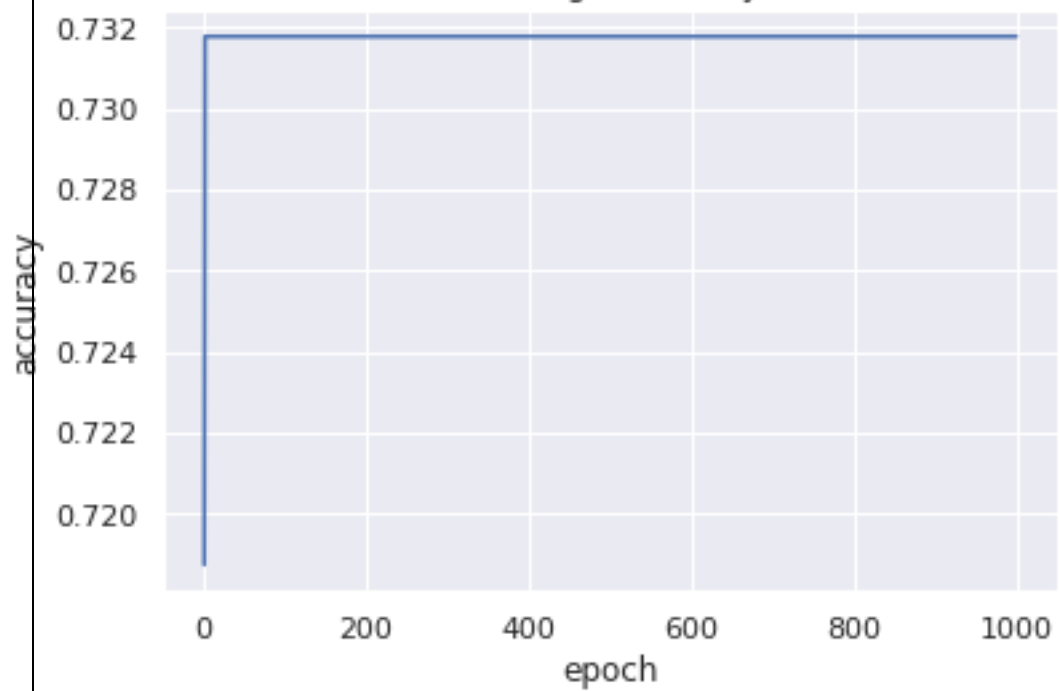
▪ نمودار تغییر Loss مجموعه ارزیابی

Test Loss



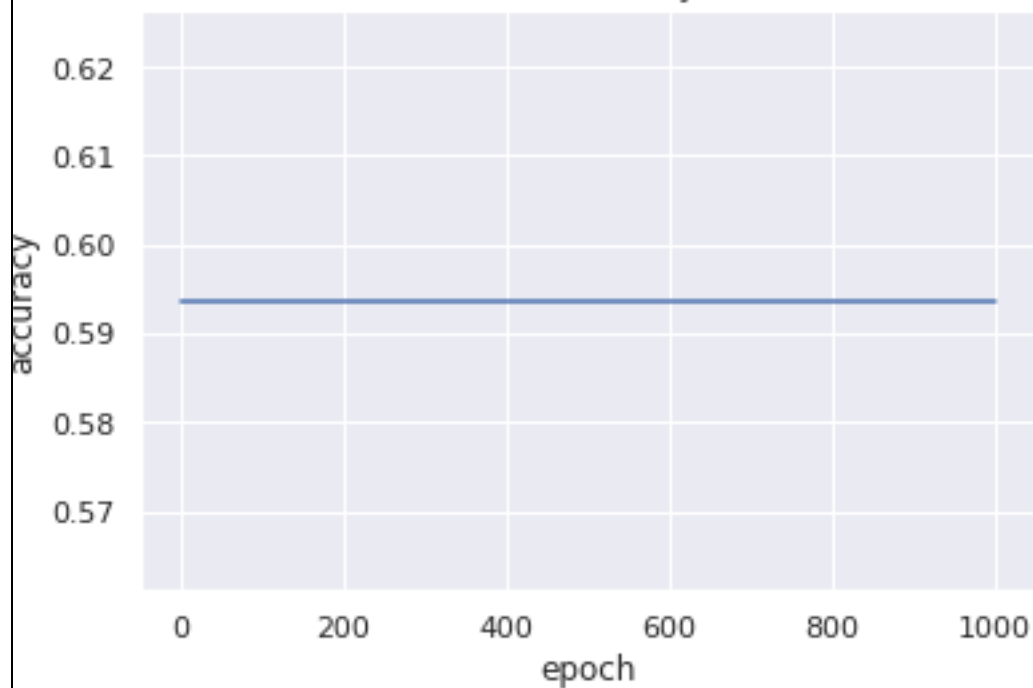
▪ نمودار تغییر Accuracy مجموعه آموزش

Training Accuracy



▪ نمودار تغییر Accuracy مجموعه ارزیابی

Test Accuracy



- توضیحات تکمیلی:
همانگونه که در نمودار ها مشاهده می کنید هنگامی مقدار اولیه صفر است، مدل یادگیری را به درستی انجام نمی دهد و Test Accuracy ثابت خواهد بود.
- نتایج بهبود مدل (نمره مثبت):