به نام خدا

گزارش پروژه اول درس یادگیری عمیق

دکتر سید ابوالقاسم میرروشندل

تاریخ تحویل: 1401/01/15

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- **نتایج به ازای مقداردهی اولیه رندوم**

مقدار α و k: 1000, 0.01				
تعداد لایه	Loss و Accuracy بهترین مدل (بر اساس کمترین (Loss) - مجموعه آموزش	Loss و Accuracy بهترین مدل (بر اساس بیشترین (Accuracy) - مجموعه آموزش	Loss و Accuracy بهترین مدل (بر اساس کمترین (Loss) - مجموعه ارزیابی	Loss و Accuracy بهترین مدل (بر اساس بیشترین (Accuracy) - مجموعه ارزیابی
2	0.23-94.01%	0.23-94.01%	0.22-91.66%	0.22-91.66%
3	0.12-97.39%	0.12 - 97.39%	0.20- 91.66%	0.20 - 91.66%
5	0.10-96.875%	0.10-96.875%	0.26-90.625%	0.26-90.625%

- **تعداد لایه=2:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 1.113165519253767        train accuracy: 29.427083333333325
--------------------------------------------------------------------------------
Cost iteration 10: 1.0238346527632545        train accuracy: 35.67708333333333
--------------------------------------------------------------------------------
Cost iteration 20: 0.9488533181324725        train accuracy: 40.885416666666664
--------------------------------------------------------------------------------
Cost iteration 30: 0.8855298255411574        train accuracy: 44.791666666666664
--------------------------------------------------------------------------------
Cost iteration 40: 0.8316163156989249        train accuracy: 50.52083333333333
--------------------------------------------------------------------------------
Cost iteration 50: 0.7853004721418282        train accuracy: 54.166666666666664
--------------------------------------------------------------------------------
Cost iteration 60: 0.7451468156004478        train accuracy: 59.375
--------------------------------------------------------------------------------
Cost iteration 70: 0.7100256851241832        train accuracy: 63.02083333333333
--------------------------------------------------------------------------------
Cost iteration 80: 0.67904778388719        train accuracy: 66.14583333333333
--------------------------------------------------------------------------------
Cost iteration 90: 0.6515100988741489        train accuracy: 68.22916666666667
--------------------------------------------------------------------------------
Cost iteration 100: 0.6268534379935029        train accuracy: 69.53125
--------------------------------------------------------------------------------
Cost iteration 110: 0.6046298505155199        train accuracy: 70.57291666666667
--------------------------------------------------------------------------------
Cost iteration 120: 0.5844778358046762        train accuracy: 72.91666666666667
--------------------------------------------------------------------------------
Cost iteration 130: 0.5661034823928439        train accuracy: 74.47916666666667
--------------------------------------------------------------------------------
Cost iteration 140: 0.5492660634068417        train accuracy: 75.52083333333334
--------------------------------------------------------------------------------
Cost iteration 150: 0.5337669741605877        train accuracy: 75.78125
--------------------------------------------------------------------------------
Cost iteration 160: 0.5194411854632889        train accuracy: 76.82291666666667
```

```
Cost iteration 170: 0.5061506016689626        train accuracy: 78.125
Cost iteration 180: 0.49377886977681174        train accuracy: 78.90625
Cost iteration 190: 0.48222730019946863        train accuracy: 79.6875
Cost iteration 200: 0.471411643421555        train accuracy: 79.94791666666667
Cost iteration 210: 0.46125952856001473        train accuracy: 81.51041666666666
Cost iteration 220: 0.45170841598211414        train accuracy: 81.77083333333333
Cost iteration 230: 0.4427039508972348        train accuracy: 82.29166666666667
Cost iteration 240: 0.43419863119223995        train accuracy: 82.55208333333334
Cost iteration 250: 0.42615072284832956        train accuracy: 82.8125
Cost iteration 260: 0.4185233715991888        train accuracy: 84.11458333333333
Cost iteration 270: 0.411283871199049        train accuracy: 84.375
Cost iteration 280: 0.40440305761057616        train accuracy: 84.63541666666667
Cost iteration 290: 0.3978548052343921        train accuracy: 84.89583333333333
Cost iteration 300: 0.39161560647352106        train accuracy: 85.15625
Cost iteration 310: 0.3856642198378927        train accuracy: 85.15625
Cost iteration 320: 0.3799813747471097        train accuracy: 85.15625
Cost iteration 330: 0.3745495234238261        train accuracy: 85.67708333333334
Cost iteration 340: 0.36935263197582546        train accuracy: 85.9375
Cost iteration 350: 0.36437600409071125        train accuracy: 85.9375
Cost iteration 360: 0.3596061318251871        train accuracy: 86.19791666666667
Cost iteration 370: 0.3550305688412869        train accuracy: 86.45833333333334
Cost iteration 380: 0.35063782217876416        train accuracy: 86.45833333333334
Cost iteration 390: 0.3464172592894359        train accuracy: 86.71875
Cost iteration 400: 0.3423590276146362        train accuracy: 87.5
Cost iteration 410: 0.3384539844708548        train accuracy: 87.5
Cost iteration 420: 0.33469363542629665        train accuracy: 87.76041666666667
Cost iteration 430: 0.33107007970615276        train accuracy: 88.28125
Cost iteration 440: 0.3275759614606114        train accuracy: 88.54166666666667
Cost iteration 450: 0.3242044259719875        train accuracy: 88.54166666666667
Cost iteration 460: 0.3209490800716978        train accuracy: 89.0625
Cost iteration 470: 0.31780395619074653        train accuracy: 89.32291666666667
Cost iteration 480: 0.3147634795857361        train accuracy: 89.32291666666667
Cost iteration 490: 0.3118224383727046        train accuracy: 89.58333333333334
Cost iteration 500: 0.30897595606919126        train accuracy: 89.84375
Cost iteration 510: 0.30621946639604536        train accuracy: 89.84375
Cost iteration 520: 0.3035486901287472        train accuracy: 89.84375
Cost iteration 530: 0.3009596138168781        train accuracy: 90.10416666666667
Cost iteration 540: 0.2984484702124277        train accuracy: 90.10416666666667
Cost iteration 550: 0.29601172026483596        train accuracy: 90.10416666666667
Cost iteration 560: 0.29364603655446564        train accuracy: 90.10416666666667
```

```
Cost iteration 570: 0.2913482880476317        train accuracy: 90.10416666666667
--------------------------------------------------------------------------------
Cost iteration 580: 0.28911552606605645        train accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 590: 0.2869449713721808        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 600: 0.2848340022794462        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 610: 0.28278014370369187        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 620: 0.28078105707827905        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 630: 0.2788345310616109        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 640: 0.27693847297131763        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 650: 0.2750909008846484        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 660: 0.27328993634949933        train accuracy: 91.40625
--------------------------------------------------------------------------------
Cost iteration 670: 0.2715337976550831        train accuracy: 91.40625
--------------------------------------------------------------------------------
Cost iteration 680: 0.269820793615467        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 690: 0.26814931782316287        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 700: 0.2665178433335701        train accuracy: 92.44791666666667
--------------------------------------------------------------------------------
Cost iteration 710: 0.2649249177444301        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 720: 0.2633691586375354        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 730: 0.26184924935278875        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 740: 0.2603639350672782        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 750: 0.25891201915444        train accuracy: 92.44791666666667
--------------------------------------------------------------------------------
Cost iteration 760: 0.2574923598005447        train accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 770: 0.2561038668577317        train accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 780: 0.25474549891462867        train accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 790: 0.25341626056724437        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 800: 0.25211519987433134        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 810: 0.25084140598277505        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 820: 0.24959400690982425        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 830: 0.24837216747010044        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 840: 0.2471750873363639        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 850: 0.24600199922394234        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 860: 0.24485216718959107        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 870: 0.24372488503632073        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 880: 0.24261947481644067        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 890: 0.24153528542569982        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 900: 0.2404716912820072        train accuracy: 94.27083333333334
--------------------------------------------------------------------------------
Cost iteration 910: 0.2394280910827227        train accuracy: 94.27083333333334
--------------------------------------------------------------------------------
Cost iteration 920: 0.23840390663502214        train accuracy: 94.27083333333334
--------------------------------------------------------------------------------
Cost iteration 930: 0.2373985817542508        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 940: 0.23641158122561562        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 950: 0.2354423898249032        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 960: 0.23449051139427138        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 970: 0.2335554679694454        train accuracy: 94.01041666666667
```

```
Cost iteration 980: 0.23263679895495637        train accuracy: 94.01041666666667
Cost iteration 990: 0.23173406034428606        train accuracy: 94.01041666666667
Cost iteration 1000: 0.2308468239820436        train accuracy: 94.01041666666667
```

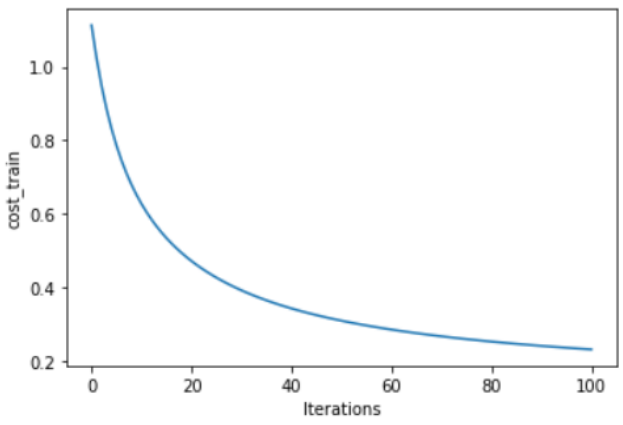
- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

```
Cost iteration 0: 1.022109253094689        test accuracy: 28.125
Cost iteration 10: 0.9379873788874162        test accuracy: 31.25
Cost iteration 20: 0.8663726472531118        test accuracy: 35.416666666666664
Cost iteration 30: 0.8051227330706869        test accuracy: 43.74999999999999
Cost iteration 40: 0.7524095545149493        test accuracy: 48.95833333333333
Cost iteration 50: 0.7067280683696178        test accuracy: 54.166666666666664
Cost iteration 60: 0.6668616313158124        test accuracy: 58.33333333333333
Cost iteration 70: 0.6318333802108866        test accuracy: 64.58333333333333
Cost iteration 80: 0.6008588639915544        test accuracy: 67.70833333333333
Cost iteration 90: 0.5733056589428385        test accuracy: 68.75
Cost iteration 100: 0.5486609537065891        test accuracy: 69.79166666666666
Cost iteration 110: 0.5265062257513138        test accuracy: 72.91666666666666
Cost iteration 120: 0.5064976463294053        test accuracy: 73.95833333333334
Cost iteration 130: 0.4883509171074272        test accuracy: 75.0
Cost iteration 140: 0.47182947526500835        test accuracy: 77.08333333333334
Cost iteration 150: 0.4567352502377507        test accuracy: 79.16666666666666
Cost iteration 160: 0.4429013630318833        test accuracy: 80.20833333333333
Cost iteration 170: 0.4301863189355244        test accuracy: 80.20833333333333
Cost iteration 180: 0.4184693621378174        test accuracy: 80.20833333333333
Cost iteration 190: 0.40764674545219637        test accuracy: 80.20833333333333
Cost iteration 200: 0.39762872865307514        test accuracy: 80.20833333333333
Cost iteration 210: 0.388337161801686        test accuracy: 81.25
Cost iteration 220: 0.3797035405811236        test accuracy: 83.33333333333334
Cost iteration 230: 0.37166744292092824        test accuracy: 84.375
Cost iteration 240: 0.3641752728354338        test accuracy: 86.45833333333334
Cost iteration 250: 0.3571792503659973        test accuracy: 86.45833333333334
Cost iteration 260: 0.3506365970932177        test accuracy: 87.5
Cost iteration 270: 0.3445088756568504        test accuracy: 89.58333333333334
Cost iteration 280: 0.3387614495085545        test accuracy: 89.58333333333334
Cost iteration 290: 0.3333630359091794        test accuracy: 90.625
Cost iteration 300: 0.32828533102586255        test accuracy: 90.625
Cost iteration 310: 0.32350269090114314        test accuracy: 90.625
Cost iteration 320: 0.3189918560831976        test accuracy: 90.625
Cost iteration 330: 0.31473171088275076        test accuracy: 90.625
```

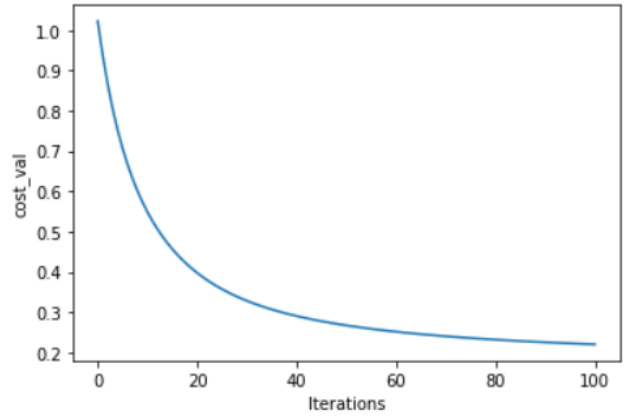
```
Cost iteration 340: 0.31070307065126834        test accuracy: 90.625
Cost iteration 350: 0.306888492272407        test accuracy: 90.625
Cost iteration 360: 0.30327210434770824        test accuracy: 91.66666666666667
Cost iteration 370: 0.29983945445600757        test accuracy: 91.66666666666667
Cost iteration 380: 0.2965773714774771        test accuracy: 91.66666666666667
Cost iteration 390: 0.2934738413823833        test accuracy: 91.66666666666667
Cost iteration 400: 0.29051789515699733        test accuracy: 91.66666666666667
Cost iteration 410: 0.28769950772266156        test accuracy: 91.66666666666667
Cost iteration 420: 0.2850095068322669        test accuracy: 91.66666666666667
Cost iteration 430: 0.28243949102366395        test accuracy: 91.66666666666667
Cost iteration 440: 0.27998175578590945        test accuracy: 92.70833333333334
Cost iteration 450: 0.2776292271601976        test accuracy: 93.75
Cost iteration 460: 0.2753754020575374        test accuracy: 93.75
Cost iteration 470: 0.2732142946320618        test accuracy: 93.75
Cost iteration 480: 0.27114038810325125        test accuracy: 93.75
Cost iteration 490: 0.269148591472552        test accuracy: 93.75
Cost iteration 500: 0.26723420062971065        test accuracy: 93.75
Cost iteration 510: 0.2653928633913649        test accuracy: 93.75
Cost iteration 520: 0.2636205480587951        test accuracy: 93.75
Cost iteration 530: 0.26191351512300853        test accuracy: 93.75
Cost iteration 540: 0.2602682917834584        test accuracy: 94.79166666666667
Cost iteration 550: 0.2586816489816084        test accuracy: 94.79166666666667
Cost iteration 560: 0.2571505806823551        test accuracy: 93.75
Cost iteration 570: 0.25567228516510077        test accuracy: 93.75
Cost iteration 580: 0.25424414811219365        test accuracy: 93.75
Cost iteration 590: 0.25286372730572326        test accuracy: 93.75
Cost iteration 600: 0.25152873876445514        test accuracy: 93.75
Cost iteration 610: 0.25023704417125975        test accuracy: 93.75
Cost iteration 620: 0.24898663945788937        test accuracy: 93.75
Cost iteration 630: 0.2477756444286376        test accuracy: 93.75
Cost iteration 640: 0.24660229331743957        test accuracy: 93.75
Cost iteration 650: 0.2454649261845037        test accuracy: 93.75
Cost iteration 660: 0.24436198106880636        test accuracy: 92.70833333333334
Cost iteration 670: 0.24329198682183586        test accuracy: 92.70833333333334
Cost iteration 680: 0.24225355655600378        test accuracy: 92.70833333333334
Cost iteration 690: 0.24124538164825052        test accuracy: 92.70833333333334
Cost iteration 700: 0.24026622624568353        test accuracy: 92.70833333333334
Cost iteration 710: 0.23931492222566697        test accuracy: 92.70833333333334
Cost iteration 720: 0.23839036456774926        test accuracy: 92.70833333333334
Cost iteration 730: 0.23749150709922012        test accuracy: 92.70833333333334
```

```
Cost iteration 740: 0.23661735857999525        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 750: 0.235766979096016        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 760: 0.23493947673344553        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 770: 0.23413400450870217        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 780: 0.2333497575318393        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 790: 0.23258597038297368        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 800: 0.23184191468342902        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 810: 0.2311168968450225        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 820: 0.23041025598249104        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 830: 0.22972136197546794        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 840: 0.22904961366768167        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 850: 0.22839443719219132        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 860: 0.22775528441248882        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 870: 0.22713163147021898        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 880: 0.22652297743110072        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 890: 0.22592884302137484        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 900: 0.22534876944777807        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 910: 0.22478231729465542        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 920: 0.22422906549237115        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 930: 0.22368861035167467        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 940: 0.2231605646591337        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 950: 0.22264455682915513        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 960: 0.22214023010847964        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 970: 0.22164724182938425        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 980: 0.22116526270812434        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 990: 0.2206939761854277        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 1000: 0.22023307780611460        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
                                                                    -------------
```

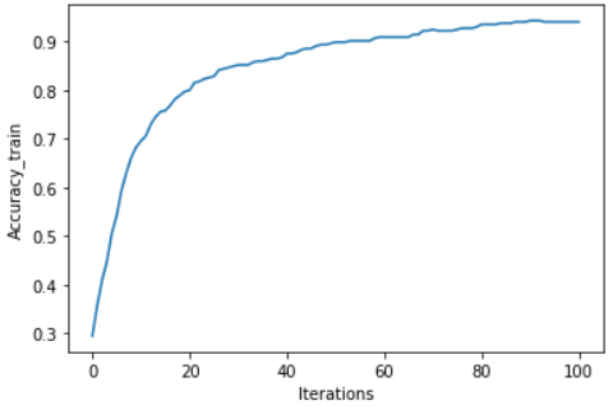
- **نمودار تغییر Loss مجموعه آموزش**



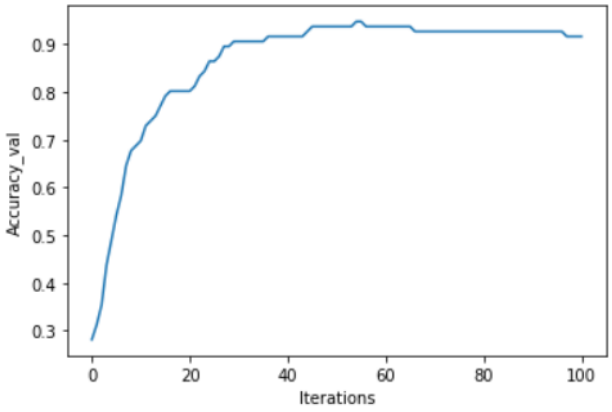
- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**



- **تعداد لایه=3:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 0.7878653018584393        train accuracy: 55.729166666666664
-------------------------------------------------------------------------------
Cost iteration 10: 0.6806693634546779        train accuracy: 65.36458333333333
-------------------------------------------------------------------------------
Cost iteration 20: 0.6125618106023529        train accuracy: 70.3125
-------------------------------------------------------------------------------
Cost iteration 30: 0.5613354363464718        train accuracy: 72.91666666666667
-------------------------------------------------------------------------------
Cost iteration 40: 0.5198845111357786        train accuracy: 76.30208333333334
-------------------------------------------------------------------------------
Cost iteration 50: 0.48532351220227177        train accuracy: 79.16666666666666
-------------------------------------------------------------------------------
Cost iteration 60: 0.4560457958523226        train accuracy: 82.55208333333334
-------------------------------------------------------------------------------
Cost iteration 70: 0.4308710444367607        train accuracy: 82.8125
```

```
Cost iteration 80: 0.4090232845999247        train accuracy: 83.59375
Cost iteration 90: 0.38988873792292056        train accuracy: 83.59375
Cost iteration 100: 0.37296869597183824        train accuracy: 83.59375
Cost iteration 110: 0.3579259045930319        train accuracy: 84.89583333333334
Cost iteration 120: 0.3444760404037591        train accuracy: 85.9375
Cost iteration 130: 0.3323406525739754        train accuracy: 87.23958333333334
Cost iteration 140: 0.3213373169331427        train accuracy: 88.28125
Cost iteration 150: 0.3113063364512575        train accuracy: 89.0625
Cost iteration 160: 0.3021182209698178        train accuracy: 89.84375
Cost iteration 170: 0.29366804336013796        train accuracy: 90.10416666666667
Cost iteration 180: 0.2858560721854767        train accuracy: 90.36458333333334
Cost iteration 190: 0.27862361031204075        train accuracy: 90.36458333333334
Cost iteration 200: 0.2719003227046325        train accuracy: 91.14583333333334
Cost iteration 210: 0.26563113892418344        train accuracy: 91.40625
Cost iteration 220: 0.2597723751319951        train accuracy: 91.40625
Cost iteration 230: 0.2542802130113073        train accuracy: 92.1875
Cost iteration 240: 0.24912072352054973        train accuracy: 92.70833333333334
Cost iteration 250: 0.24427096541655238        train accuracy: 92.44791666666667
Cost iteration 260: 0.23968885836089343        train accuracy: 92.96875
Cost iteration 270: 0.23533763937669272        train accuracy: 93.22916666666667
Cost iteration 280: 0.23121673971945145        train accuracy: 93.48958333333334
Cost iteration 290: 0.22730685846187385        train accuracy: 94.01041666666667
Cost iteration 300: 0.22359987884583582        train accuracy: 94.27083333333334
Cost iteration 310: 0.22007452309407452        train accuracy: 94.27083333333334
Cost iteration 320: 0.21671552090082336        train accuracy: 94.27083333333334
Cost iteration 330: 0.21352154797645387        train accuracy: 94.27083333333334
Cost iteration 340: 0.21046714768696298        train accuracy: 94.01041666666667
Cost iteration 350: 0.20754305736438697        train accuracy: 94.01041666666667
Cost iteration 360: 0.20474373792555028        train accuracy: 94.01041666666667
Cost iteration 370: 0.20206298360902814        train accuracy: 94.01041666666667
Cost iteration 380: 0.19950246800197258        train accuracy: 94.01041666666667
Cost iteration 390: 0.19704471521816402        train accuracy: 94.01041666666667
Cost iteration 400: 0.19467910041434905        train accuracy: 94.27083333333334
Cost iteration 410: 0.19239849097985365        train accuracy: 94.27083333333334
Cost iteration 420: 0.19019835237459862        train accuracy: 94.27083333333334
Cost iteration 430: 0.18807564876513938        train accuracy: 94.27083333333334
Cost iteration 440: 0.18603638775270592        train accuracy: 94.53125
Cost iteration 450: 0.1840683853564348        train accuracy: 94.53125
Cost iteration 460: 0.18216807081176778        train accuracy: 94.79166666666667
Cost iteration 470: 0.1803304715639872        train accuracy: 94.79166666666667
```

```
Cost iteration 480: 0.17855308275653473        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 490: 0.17682943041575339        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 500: 0.17515556946618432        train accuracy: 95.05208333333334
--------------------------------------------------------------------------------
Cost iteration 510: 0.17353103340435988        train accuracy: 95.05208333333334
--------------------------------------------------------------------------------
Cost iteration 520: 0.1719545597795175        train accuracy: 95.57291666666667
--------------------------------------------------------------------------------
Cost iteration 530: 0.17042424292660066        train accuracy: 95.57291666666667
--------------------------------------------------------------------------------
Cost iteration 540: 0.168936647946358        train accuracy: 95.57291666666667
--------------------------------------------------------------------------------
Cost iteration 550: 0.16749045719642525        train accuracy: 95.57291666666667
--------------------------------------------------------------------------------
Cost iteration 560: 0.1660822184720558        train accuracy: 95.83333333333334
--------------------------------------------------------------------------------
Cost iteration 570: 0.16471304721251023        train accuracy: 95.83333333333334
--------------------------------------------------------------------------------
Cost iteration 580: 0.16337880155688553        train accuracy: 95.83333333333334
--------------------------------------------------------------------------------
Cost iteration 590: 0.16207733660072954        train accuracy: 95.83333333333334
--------------------------------------------------------------------------------
Cost iteration 600: 0.16080798633226734        train accuracy: 95.83333333333334
--------------------------------------------------------------------------------
Cost iteration 610: 0.15957100311722053        train accuracy: 95.83333333333334
--------------------------------------------------------------------------------
Cost iteration 620: 0.15836449153408969        train accuracy: 95.83333333333334
--------------------------------------------------------------------------------
Cost iteration 630: 0.15718614194662378        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 640: 0.15603447485375627        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 650: 0.1549092476534367        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 660: 0.15380842280107893        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 670: 0.15273185866988273        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 680: 0.15167904966026832        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 690: 0.15064909981342134        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 700: 0.1496407295297826        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 710: 0.14865718070262612        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 720: 0.1476942638270642        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 730: 0.14674987837574888        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 740: 0.14582363393162484        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 750: 0.14491455227816108        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 760: 0.14402258466410445        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 770: 0.14314988749568713        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 780: 0.14229518306660638        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 790: 0.1414557492234128        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 800: 0.14063151852436517        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 810: 0.13982086929665732        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 820: 0.13902529391618        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 830: 0.13824278487673036        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 840: 0.13747313604742276        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 850: 0.13671683001486462        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 860: 0.1359741695860023        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 870: 0.13524586146592316        train accuracy: 96.35416666666667
--------------------------------------------------------------------------------
Cost iteration 880: 0.13452779161458098        train accuracy: 96.35416666666667
```

```
Cost iteration 890: 0.13382053626351903        train accuracy: 96.35416666666667
Cost iteration 900: 0.13312388222862687        train accuracy: 96.35416666666667
Cost iteration 910: 0.13243614119871686        train accuracy: 96.35416666666667
Cost iteration 920: 0.13175848211237084        train accuracy: 96.875
Cost iteration 930: 0.13109077079579876        train accuracy: 96.875
Cost iteration 940: 0.1304326629185606        train accuracy: 96.875
Cost iteration 950: 0.12978912922890726        train accuracy: 97.13541666666667
Cost iteration 960: 0.1291545910039691        train accuracy: 97.13541666666667
Cost iteration 970: 0.12852097595180834        train accuracy: 97.39583333333334
Cost iteration 980: 0.127891652424523        train accuracy: 97.39583333333334
Cost iteration 990: 0.12727124326358324        train accuracy: 97.39583333333334
Cost iteration 1000: 0.12665926515490314        train accuracy: 97.39583333333334
```

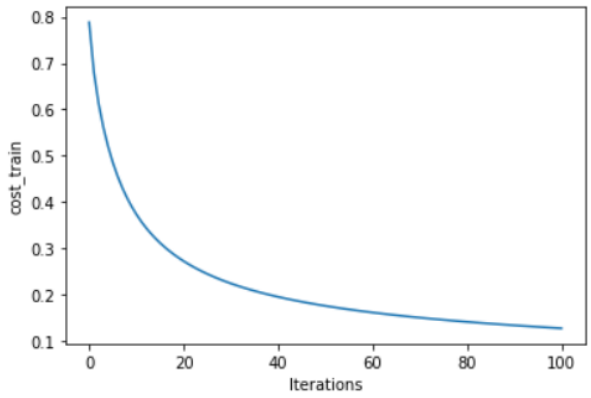
- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

```
Cost iteration 0: 0.7452738790322413        test accuracy: 57.291666666666664
Cost iteration 10: 0.6343152188286398        test accuracy: 67.70833333333334
Cost iteration 20: 0.5696096855667799        test accuracy: 75.0
Cost iteration 30: 0.5243000741743413        test accuracy: 78.125
Cost iteration 40: 0.4892518709957684        test accuracy: 79.16666666666666
Cost iteration 50: 0.46067349992355383        test accuracy: 82.29166666666667
Cost iteration 60: 0.43663989931434355        test accuracy: 82.29166666666667
Cost iteration 70: 0.41597296026789327        test accuracy: 83.33333333333334
Cost iteration 80: 0.39803769702245956        test accuracy: 84.375
Cost iteration 90: 0.38226518340209387        test accuracy: 84.375
Cost iteration 100: 0.36831307237891664        test accuracy: 84.375
Cost iteration 110: 0.3558938491345872        test accuracy: 84.375
Cost iteration 120: 0.3447735264551351        test accuracy: 84.375
Cost iteration 130: 0.3347226513622739        test accuracy: 84.375
Cost iteration 140: 0.32562787909506213        test accuracy: 83.33333333333334
Cost iteration 150: 0.31736290672414813        test accuracy: 83.33333333333334
Cost iteration 160: 0.3098222027119907        test accuracy: 85.41666666666667
Cost iteration 170: 0.3029282902474084        test accuracy: 87.5
Cost iteration 180: 0.2965937098817928        test accuracy: 87.5
Cost iteration 190: 0.29076405077883033        test accuracy: 87.5
Cost iteration 200: 0.28537603653501253        test accuracy: 88.54166666666667
Cost iteration 210: 0.28039859482888624        test accuracy: 88.54166666666667
Cost iteration 220: 0.2757922070191576        test accuracy: 88.54166666666667
Cost iteration 230: 0.271504887259322        test accuracy: 89.58333333333334
Cost iteration 240: 0.26751582857470735        test accuracy: 89.58333333333334
```

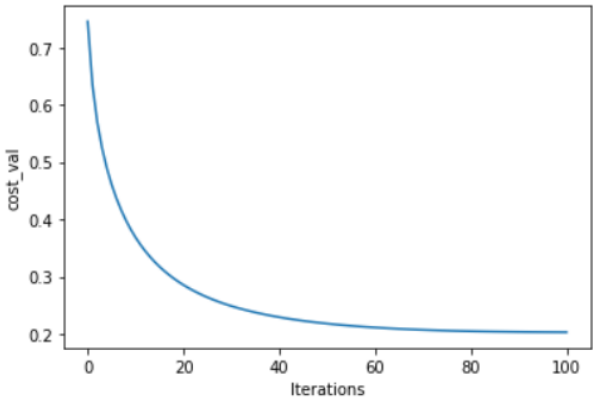
```
Cost iteration 250: 0.2638184087212868        test accuracy: 89.58333333333334
Cost iteration 260: 0.26035970018587573        test accuracy: 89.58333333333334
Cost iteration 270: 0.25711225664902854        test accuracy: 89.58333333333334
Cost iteration 280: 0.254073415988124        test accuracy: 89.58333333333334
Cost iteration 290: 0.25122406092871186        test accuracy: 89.58333333333334
Cost iteration 300: 0.24856319468735266        test accuracy: 89.58333333333334
Cost iteration 310: 0.24607878228050908        test accuracy: 89.58333333333334
Cost iteration 320: 0.2437428493190498        test accuracy: 89.58333333333334
Cost iteration 330: 0.24154396344162404        test accuracy: 88.54166666666667
Cost iteration 340: 0.2394673848183932        test accuracy: 88.54166666666667
Cost iteration 350: 0.23750194693954865        test accuracy: 88.54166666666667
Cost iteration 360: 0.2356442619308326        test accuracy: 88.54166666666667
Cost iteration 370: 0.23388572451866932        test accuracy: 88.54166666666667
Cost iteration 380: 0.23222240532206861        test accuracy: 88.54166666666667
Cost iteration 390: 0.23064765508213947        test accuracy: 88.54166666666667
Cost iteration 400: 0.22915869448440898        test accuracy: 89.58333333333334
Cost iteration 410: 0.22774557970481238        test accuracy: 89.58333333333334
Cost iteration 420: 0.22640280561304366        test accuracy: 89.58333333333334
Cost iteration 430: 0.2251276942088315        test accuracy: 89.58333333333334
Cost iteration 440: 0.22392576784011692        test accuracy: 89.58333333333334
Cost iteration 450: 0.2227874109297724        test accuracy: 89.58333333333334
Cost iteration 460: 0.22170956780873158        test accuracy: 89.58333333333334
Cost iteration 470: 0.2206853784815224        test accuracy: 89.58333333333334
Cost iteration 480: 0.21971258454081669        test accuracy: 89.58333333333334
Cost iteration 490: 0.2187872120333752        test accuracy: 89.58333333333334
Cost iteration 500: 0.2179050222626402        test accuracy: 89.58333333333334
Cost iteration 510: 0.21706528421072463        test accuracy: 90.625
Cost iteration 520: 0.2162630657548768        test accuracy: 90.625
Cost iteration 530: 0.21550004082523624        test accuracy: 90.625
Cost iteration 540: 0.21477724625304012        test accuracy: 90.625
Cost iteration 550: 0.21408811011715922        test accuracy: 90.625
Cost iteration 560: 0.21343228629861982        test accuracy: 90.625
Cost iteration 570: 0.21281116035946063        test accuracy: 90.625
Cost iteration 580: 0.21221996224636222        test accuracy: 91.66666666666667
Cost iteration 590: 0.2116567378877872        test accuracy: 91.66666666666667
Cost iteration 600: 0.21112219599499518        test accuracy: 91.66666666666667
Cost iteration 610: 0.21061391757429454        test accuracy: 91.66666666666667
Cost iteration 620: 0.21012965183731683        test accuracy: 91.66666666666667
Cost iteration 630: 0.20966627886056233        test accuracy: 91.66666666666667
Cost iteration 640: 0.20922675024008178        test accuracy: 91.66666666666667
```

```
Cost iteration 650: 0.20881038167287064        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 660: 0.2084147125422278        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 670: 0.20803544505763566        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 680: 0.20767973605929238        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 690: 0.20734486687851        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 700: 0.20702439997689825        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 710: 0.2067185453455828        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 720: 0.20642689458942912        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 730: 0.2061468912874689        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 740: 0.20588199073389896        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 750: 0.20563142400097933        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 760: 0.20539443722920073        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 770: 0.2051841901107499        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 780: 0.20499428594356162        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 790: 0.2048159403795549        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 800: 0.20464722127951052        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 810: 0.2044906073258728        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 820: 0.20434408913217375        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 830: 0.2042081463504554        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 840: 0.20408153908746132        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 850: 0.2039631267123424        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 860: 0.20385413255591706        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 870: 0.20374924573441494        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 880: 0.20365324926259187        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 890: 0.20356411408761066        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 900: 0.20347257023107315        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 910: 0.2033883108941515        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 920: 0.20330852587005036        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 930: 0.20323856129216689        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 940: 0.20317521768523178        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 950: 0.20312049748429475        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 960: 0.2030741232268747        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 970: 0.20301966679413774        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 980: 0.20296656245274403        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 990: 0.2029161776040549        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 1000: 0.20287385527281143        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
                                                -------------
```

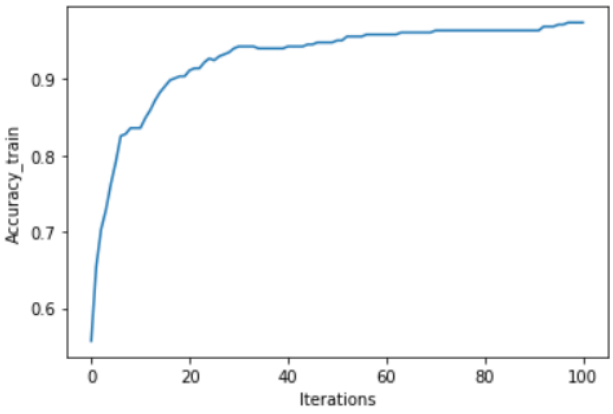
- **نمودار تغییر Loss مجموعه آموزش**



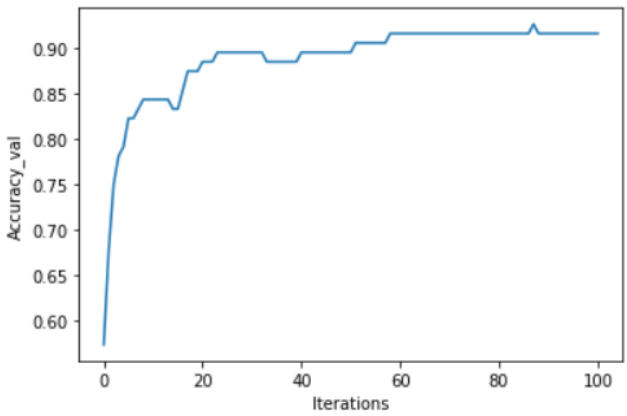
- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**



- **تعداد لایه=5:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 0.9110196321580607        train accuracy: 34.11458333333333
-----------------------------------------------------------------------------
Cost iteration 10: 0.7005021303474022        train accuracy: 54.6875
-----------------------------------------------------------------------------
Cost iteration 20: 0.6177916028158965        train accuracy: 67.96875
-----------------------------------------------------------------------------
Cost iteration 30: 0.5748137677512426        train accuracy: 72.91666666666667
-----------------------------------------------------------------------------
Cost iteration 40: 0.5482092195491491        train accuracy: 72.65625
-----------------------------------------------------------------------------
Cost iteration 50: 0.5284736790736766        train accuracy: 73.17708333333334
-----------------------------------------------------------------------------
Cost iteration 60: 0.5126694593966565        train accuracy: 73.4375
-----------------------------------------------------------------------------
Cost iteration 70: 0.49913329091811326        train accuracy: 73.69791666666667
-----------------------------------------------------------------------------
Cost iteration 80: 0.48624835469856703        train accuracy: 73.95833333333334
-----------------------------------------------------------------------------
Cost iteration 90: 0.47399758455398056        train accuracy: 75.0
-----------------------------------------------------------------------------
Cost iteration 100: 0.46220470499087046        train accuracy: 76.04166666666667
-----------------------------------------------------------------------------
Cost iteration 110: 0.45114278262021973        train accuracy: 77.60416666666666
-----------------------------------------------------------------------------
Cost iteration 120: 0.4402148527140226        train accuracy: 78.90625
-----------------------------------------------------------------------------
Cost iteration 130: 0.4296200130200102        train accuracy: 80.20833333333334
-----------------------------------------------------------------------------
Cost iteration 140: 0.4193769225804583        train accuracy: 80.46875
-----------------------------------------------------------------------------
Cost iteration 150: 0.40904507943957436        train accuracy: 82.29166666666666
-----------------------------------------------------------------------------
Cost iteration 160: 0.3989790485553186        train accuracy: 83.33333333333334
-----------------------------------------------------------------------------
Cost iteration 170: 0.38905085456397626        train accuracy: 83.85416666666666
-----------------------------------------------------------------------------
Cost iteration 180: 0.37937478926024826        train accuracy: 84.11458333333333
-----------------------------------------------------------------------------
Cost iteration 190: 0.3700200408520401        train accuracy: 84.375
-----------------------------------------------------------------------------
Cost iteration 200: 0.36090129788142233        train accuracy: 84.375
-----------------------------------------------------------------------------
Cost iteration 210: 0.3521356502089198        train accuracy: 84.63541666666666
-----------------------------------------------------------------------------
Cost iteration 220: 0.34379753380537675        train accuracy: 84.89583333333333
-----------------------------------------------------------------------------
Cost iteration 230: 0.3358002367501157        train accuracy: 85.41666666666667
-----------------------------------------------------------------------------
Cost iteration 240: 0.32803614850512586        train accuracy: 85.67708333333334
-----------------------------------------------------------------------------
Cost iteration 250: 0.320562106762308        train accuracy: 87.23958333333334
-----------------------------------------------------------------------------
Cost iteration 260: 0.31339059427645277        train accuracy: 87.5
-----------------------------------------------------------------------------
Cost iteration 270: 0.30652165833088624        train accuracy: 87.76041666666667
-----------------------------------------------------------------------------
Cost iteration 280: 0.29991324191835156        train accuracy: 88.02083333333334
-----------------------------------------------------------------------------
Cost iteration 290: 0.29355322159661335        train accuracy: 88.54166666666667
-----------------------------------------------------------------------------
Cost iteration 300: 0.2874459846584553        train accuracy: 88.80208333333334
-----------------------------------------------------------------------------
Cost iteration 310: 0.28155760994117346        train accuracy: 89.0625
-----------------------------------------------------------------------------
Cost iteration 320: 0.275865099906029        train accuracy: 88.80208333333334
-----------------------------------------------------------------------------
Cost iteration 330: 0.2704577609393066        train accuracy: 89.0625
-----------------------------------------------------------------------------
Cost iteration 340: 0.26527522771602224        train accuracy: 88.80208333333334
-----------------------------------------------------------------------------
Cost iteration 350: 0.260233876567303        train accuracy: 89.0625
-----------------------------------------------------------------------------
Cost iteration 360: 0.25532256894442673        train accuracy: 89.32291666666667
-----------------------------------------------------------------------------
Cost iteration 370: 0.25056793078381717        train accuracy: 89.32291666666667
-----------------------------------------------------------------------------
Cost iteration 380: 0.24592622267620937        train accuracy: 89.84375
```

```
Cost iteration 390: 0.2414320321194531        train accuracy: 89.84375
Cost iteration 400: 0.23706630181212063        train accuracy: 90.625
Cost iteration 410: 0.2328403542485479        train accuracy: 90.88541666666667
Cost iteration 420: 0.22872378797302756        train accuracy: 90.88541666666667
Cost iteration 430: 0.22470226981846314        train accuracy: 90.88541666666667
Cost iteration 440: 0.22078575346523088        train accuracy: 91.40625
Cost iteration 450: 0.21700505629020023        train accuracy: 91.92708333333334
Cost iteration 460: 0.21334017270057032        train accuracy: 91.92708333333334
Cost iteration 470: 0.20979858631366355        train accuracy: 91.92708333333334
Cost iteration 480: 0.20637508763470713        train accuracy: 92.1875
Cost iteration 490: 0.20303639263387274        train accuracy: 92.96875
Cost iteration 500: 0.19980928601760398        train accuracy: 93.22916666666667
Cost iteration 510: 0.1966600396985902        train accuracy: 93.22916666666667
Cost iteration 520: 0.1935870162124383        train accuracy: 93.22916666666667
Cost iteration 530: 0.19059547438749427        train accuracy: 93.48958333333334
Cost iteration 540: 0.18768791492372122        train accuracy: 93.48958333333334
Cost iteration 550: 0.1848797958601275        train accuracy: 93.48958333333334
Cost iteration 560: 0.1821668038117177        train accuracy: 93.75
Cost iteration 570: 0.17953664026215416        train accuracy: 93.75
Cost iteration 580: 0.17697849984567104        train accuracy: 94.01041666666667
Cost iteration 590: 0.17448686935660646        train accuracy: 94.27083333333334
Cost iteration 600: 0.17205101196205785        train accuracy: 95.05208333333334
Cost iteration 610: 0.16966396472114248        train accuracy: 95.57291666666667
Cost iteration 620: 0.16733615941938534        train accuracy: 95.57291666666667
Cost iteration 630: 0.16501843371322217        train accuracy: 95.57291666666667
Cost iteration 640: 0.16277251438360735        train accuracy: 95.57291666666667
Cost iteration 650: 0.16063783916282412        train accuracy: 95.83333333333334
Cost iteration 660: 0.1585596502471821        train accuracy: 95.83333333333334
Cost iteration 670: 0.15650412860401652        train accuracy: 95.83333333333334
Cost iteration 680: 0.15447906580143977        train accuracy: 95.83333333333334
Cost iteration 690: 0.1525046152406353        train accuracy: 96.09375
Cost iteration 700: 0.15057347780478134        train accuracy: 96.09375
Cost iteration 710: 0.14869312771729024        train accuracy: 96.09375
Cost iteration 720: 0.1468406082932155        train accuracy: 96.09375
Cost iteration 730: 0.14501873139483484        train accuracy: 96.09375
Cost iteration 740: 0.14322165344418197        train accuracy: 96.09375
Cost iteration 750: 0.14145738827485876        train accuracy: 96.09375
Cost iteration 760: 0.1397286125525469        train accuracy: 96.09375
Cost iteration 770: 0.13803174165925503        train accuracy: 96.09375
Cost iteration 780: 0.13637022154147965        train accuracy: 96.09375
```

```
Cost iteration 790: 0.13473661151148908        train accuracy: 96.09375
Cost iteration 800: 0.13314243529136732        train accuracy: 96.09375
Cost iteration 810: 0.13159175006494872        train accuracy: 96.09375
Cost iteration 820: 0.13008129123635534        train accuracy: 96.35416666666667
Cost iteration 830: 0.12861936047302996        train accuracy: 96.35416666666667
Cost iteration 840: 0.12719034528244705        train accuracy: 96.35416666666667
Cost iteration 850: 0.12578337686525276        train accuracy: 96.35416666666667
Cost iteration 860: 0.1244090163835416        train accuracy: 96.35416666666667
Cost iteration 870: 0.1230663384572531        train accuracy: 96.35416666666667
Cost iteration 880: 0.12173942180779908        train accuracy: 96.35416666666667
Cost iteration 890: 0.1204415629395741        train accuracy: 96.35416666666667
Cost iteration 900: 0.11916573727577319        train accuracy: 96.61458333333334
Cost iteration 910: 0.11790848617268096        train accuracy: 96.61458333333334
Cost iteration 920: 0.11667404979343135        train accuracy: 96.61458333333334
Cost iteration 930: 0.11546031131297314        train accuracy: 96.61458333333334
Cost iteration 940: 0.11427271117933227        train accuracy: 96.61458333333334
Cost iteration 950: 0.11310298627685147        train accuracy: 96.61458333333334
Cost iteration 960: 0.11195477301583547        train accuracy: 96.61458333333334
Cost iteration 970: 0.11080967986478765        train accuracy: 96.61458333333334
Cost iteration 980: 0.1096893640975788        train accuracy: 96.61458333333334
Cost iteration 990: 0.10858933568492873        train accuracy: 96.875
Cost iteration 1000: 0.10750881530654283        train accuracy: 96.875
```

- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

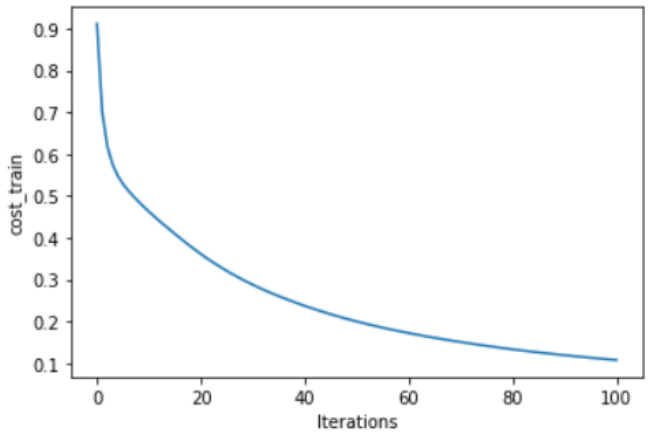
```
cost after iteration 0: 0.9539621631130802        test accuracy: 30.208333333333332
Cost after iteration 10: 0.7161265250824207        test accuracy: 56.25
Cost after iteration 20: 0.6131376906601105        test accuracy: 69.79166666666667
Cost after iteration 30: 0.5584448158478023        test accuracy: 73.95833333333334
Cost after iteration 40: 0.5248051933385135        test accuracy: 76.04166666666666
Cost after iteration 50: 0.5012413203819754        test accuracy: 77.08333333333333
Cost after iteration 60: 0.4837919764598438        test accuracy: 78.125
Cost after iteration 70: 0.46998211518638866        test accuracy: 79.16666666666666
Cost after iteration 80: 0.4582517294685108        test accuracy: 79.16666666666666
Cost after iteration 90: 0.44772401569110426        test accuracy: 79.16666666666666
Cost after iteration 100: 0.43806733056771197        test accuracy: 79.16666666666666
Cost after iteration 110: 0.42899626588553685        test accuracy: 79.16666666666667
Cost after iteration 120: 0.42049103815203437        test accuracy: 79.16666666666667
Cost after iteration 130: 0.41238834614699976        test accuracy: 80.20833333333333
Cost after iteration 140: 0.40475463393530836        test accuracy: 80.20833333333333
```

```
Cost after iteration 150: 0.3975796239118764        test accuracy: 80.20833333333333
--------------------------------------------------------------------------------
Cost after iteration 160: 0.3906434773768697        test accuracy: 82.29166666666667
--------------------------------------------------------------------------------
Cost after iteration 170: 0.38393900224416655        test accuracy: 83.33333333333334
--------------------------------------------------------------------------------
Cost after iteration 180: 0.37742842211734084        test accuracy: 83.33333333333334
--------------------------------------------------------------------------------
Cost after iteration 190: 0.3711467553581044        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost after iteration 200: 0.3650171537979049        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost after iteration 210: 0.3590136355041097        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost after iteration 220: 0.3533761010225427        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost after iteration 230: 0.34784235979084693        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost after iteration 240: 0.34263711419280446        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost after iteration 250: 0.3377014651030027        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost after iteration 260: 0.33312815777602556        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 270: 0.32892076700662376        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 280: 0.3249626727368798        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 290: 0.3213397367597228        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 300: 0.31806360960940183        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 310: 0.3150225741964443        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 320: 0.3120717949352693        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 330: 0.3093128554638692        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 340: 0.3067714403928962        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 350: 0.30439247333599795        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 360: 0.3021972081768126        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 370: 0.30016099408620656        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 380: 0.29827012172284084        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 390: 0.29645579323521387        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 400: 0.2947903365407859        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 410: 0.2932108999984443        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 420: 0.29170213156517333        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 430: 0.29024868728063963        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 440: 0.28888805605634904        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 450: 0.28765379147233566        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 460: 0.286516836803413        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost after iteration 470: 0.2854585036249334        test accuracy: 86.45833333333334
--------------------------------------------------------------------------------
Cost after iteration 480: 0.2844727792271493        test accuracy: 86.45833333333334
--------------------------------------------------------------------------------
Cost after iteration 490: 0.28344244295971877        test accuracy: 85.41666666666666
--------------------------------------------------------------------------------
Cost after iteration 500: 0.2824969804917928        test accuracy: 85.41666666666666
--------------------------------------------------------------------------------
Cost after iteration 510: 0.2816096218355661        test accuracy: 85.41666666666666
--------------------------------------------------------------------------------
Cost after iteration 520: 0.28077313459009495        test accuracy: 85.41666666666666
--------------------------------------------------------------------------------
Cost after iteration 530: 0.28001565613624657        test accuracy: 85.41666666666666
--------------------------------------------------------------------------------
Cost after iteration 540: 0.27931245166924523        test accuracy: 85.41666666666666
--------------------------------------------------------------------------------
Cost after iteration 550: 0.2786458440731992        test accuracy: 85.41666666666666
```

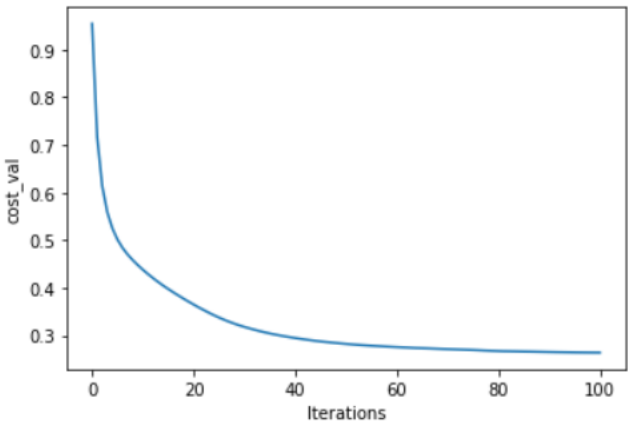
```
Cost after iteration 560: 0.2780608403679191        test accuracy: 85.41666666666666
Cost after iteration 570: 0.2774919858427199        test accuracy: 85.41666666666666
Cost after iteration 580: 0.27690352972018895        test accuracy: 85.41666666666666
Cost after iteration 590: 0.2763629421371705        test accuracy: 85.41666666666666
Cost after iteration 600: 0.275801737191454        test accuracy: 85.41666666666666
Cost after iteration 610: 0.27527603424478786        test accuracy: 85.41666666666666
Cost after iteration 620: 0.27483239009086674        test accuracy: 85.41666666666666
Cost after iteration 630: 0.27423312272340744        test accuracy: 86.45833333333334
Cost after iteration 640: 0.2738067097724606        test accuracy: 86.45833333333334
Cost after iteration 650: 0.2735101336187582        test accuracy: 86.45833333333334
Cost after iteration 660: 0.2731708401379156        test accuracy: 86.45833333333334
Cost after iteration 670: 0.272741625433882        test accuracy: 86.45833333333334
Cost after iteration 680: 0.27229888736807495        test accuracy: 86.45833333333334
Cost after iteration 690: 0.2718776419951485        test accuracy: 86.45833333333334
Cost after iteration 700: 0.2715322709915472        test accuracy: 86.45833333333334
Cost after iteration 710: 0.2711668420813764        test accuracy: 87.5
Cost after iteration 720: 0.2707955351950079        test accuracy: 87.5
Cost after iteration 730: 0.2704381257082932        test accuracy: 87.5
Cost after iteration 740: 0.2700711860373862        test accuracy: 87.5
Cost after iteration 750: 0.2697131393655022        test accuracy: 87.5
Cost after iteration 760: 0.269263041410135        test accuracy: 87.5
Cost after iteration 770: 0.2687195572223149        test accuracy: 88.54166666666667
Cost after iteration 780: 0.2682974265937692        test accuracy: 88.54166666666667
Cost after iteration 790: 0.26789879081668433        test accuracy: 88.54166666666667
Cost after iteration 800: 0.26755131117101094        test accuracy: 88.54166666666667
Cost after iteration 810: 0.26724810396042165        test accuracy: 88.54166666666667
Cost after iteration 820: 0.2671241998338575        test accuracy: 89.58333333333334
Cost after iteration 830: 0.26693958420704644        test accuracy: 89.58333333333334
Cost after iteration 840: 0.2667320272518299        test accuracy: 89.58333333333334
Cost after iteration 850: 0.26650696421830955        test accuracy: 89.58333333333334
Cost after iteration 860: 0.26635420713308916        test accuracy: 89.58333333333334
Cost after iteration 870: 0.26616873790732365        test accuracy: 89.58333333333334
Cost after iteration 880: 0.2659184918142721        test accuracy: 89.58333333333334
Cost after iteration 890: 0.26570677725573155        test accuracy: 89.58333333333334
Cost after iteration 900: 0.26548821734506733        test accuracy: 89.58333333333334
Cost after iteration 910: 0.2652739153236174        test accuracy: 89.58333333333334
Cost after iteration 920: 0.2650940022620498        test accuracy: 89.58333333333334
Cost after iteration 930: 0.26494020800114215        test accuracy: 89.58333333333334
Cost after iteration 940: 0.26478964581388276        test accuracy: 89.58333333333334
Cost after iteration 950: 0.2646125731150808        test accuracy: 89.58333333333334
```

```
Cost after iteration 960: 0.26447992832484496        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------------
Cost after iteration 970: 0.2643652423200471        test accuracy: 90.625
-------------------------------------------------------------------------------------
Cost after iteration 980: 0.26428676575582144        test accuracy: 90.625
-------------------------------------------------------------------------------------
Cost after iteration 990: 0.2642138848011899        test accuracy: 90.625
-------------------------------------------------------------------------------------
Cost after iteration 1000: 0.2641533784046264        test accuracy: 90.625
-------------------------------------------------------------------------------------
```

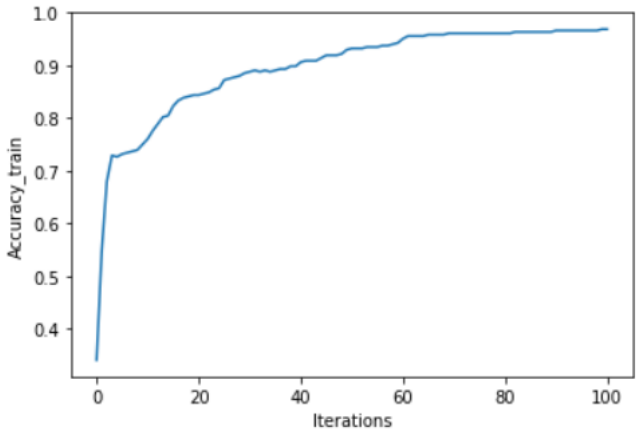
- **نمودار تغییر Loss مجموعه آموزش**



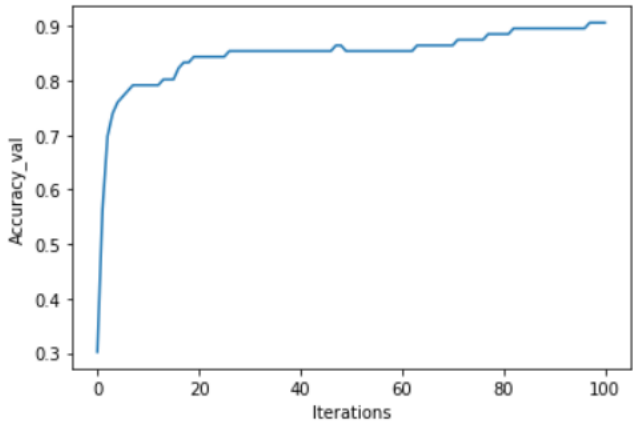
- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**



- **نتایج به ازای مقداردهی اولیه صفر**

مقدار α و k: 0.01, 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	0.21- 94.27%	0.22- 89.58%	0.21- 94.27%	0.22 - 89.58%
3	0.59 - 72.39%	0.54 - 78.125%	0.59 - 72.39%	0.54 - 78.125%
5	0.59 - 72.39%	0.54 - 78.125%	0.59 - 72.39%	0.54 - 78.125%

- **تعداد لایه=2:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 0.6931471805599467        train accuracy: 83.85416666666667
-------------------------------------------------------------------------------
Cost iteration 10: 0.6322708001922316        train accuracy: 84.11458333333334
-------------------------------------------------------------------------------
Cost iteration 20: 0.585692401638279        train accuracy: 84.11458333333334
-------------------------------------------------------------------------------
Cost iteration 30: 0.5493373316037489        train accuracy: 84.375
-------------------------------------------------------------------------------
Cost iteration 40: 0.5203279313552738        train accuracy: 84.89583333333333
-------------------------------------------------------------------------------
Cost iteration 50: 0.49667008118366357        train accuracy: 85.15625
-------------------------------------------------------------------------------
Cost iteration 60: 0.4769815782763295        train accuracy: 85.41666666666667
-------------------------------------------------------------------------------
Cost iteration 70: 0.4602944625012044        train accuracy: 85.67708333333334
-------------------------------------------------------------------------------
Cost iteration 80: 0.4459205691292654        train accuracy: 85.9375
-------------------------------------------------------------------------------
Cost iteration 90: 0.4333622657320594        train accuracy: 86.45833333333334
-------------------------------------------------------------------------------
Cost iteration 100: 0.4222533947381449        train accuracy: 86.97916666666667
-------------------------------------------------------------------------------
Cost iteration 110: 0.41231993374647075        train accuracy: 86.97916666666667
-------------------------------------------------------------------------------
Cost iteration 120: 0.40335347651785847        train accuracy: 87.23958333333334
-------------------------------------------------------------------------------
Cost iteration 130: 0.39519309962429094        train accuracy: 87.23958333333334
-------------------------------------------------------------------------------
Cost iteration 140: 0.3877127740563056        train accuracy: 87.23958333333334
```

```
Cost iteration 150: 0.3808124924900949        train accuracy: 87.23958333333334
Cost iteration 160: 0.3744119222286193        train accuracy: 87.5
Cost iteration 170: 0.3684457999772362        train accuracy: 87.76041666666667
Cost iteration 180: 0.36286054509997023        train accuracy: 87.76041666666667
Cost iteration 190: 0.35761173705389504        train accuracy: 87.76041666666667
Cost iteration 200: 0.3526622138347591        train accuracy: 88.02083333333334
Cost iteration 210: 0.3479806223034757        train accuracy: 88.28125
Cost iteration 220: 0.3435403012404956        train accuracy: 88.28125
Cost iteration 230: 0.33931841215000574        train accuracy: 88.54166666666667
Cost iteration 240: 0.33529525649858655        train accuracy: 88.80208333333334
Cost iteration 250: 0.33145373465439326        train accuracy: 88.80208333333334
Cost iteration 260: 0.32777891354607586        train accuracy: 88.80208333333334
Cost iteration 270: 0.32425767848284426        train accuracy: 89.32291666666667
Cost iteration 280: 0.32087845067536114        train accuracy: 89.32291666666667
Cost iteration 290: 0.31763095645654155        train accuracy: 89.58333333333334
Cost iteration 300: 0.3145060374930736        train accuracy: 89.84375
Cost iteration 310: 0.31149549373009516        train accuracy: 89.84375
Cost iteration 320: 0.308591952652905        train accuracy: 89.84375
Cost iteration 330: 0.30578875984403364        train accuracy: 89.84375
Cost iteration 340: 0.30307988687801846        train accuracy: 90.10416666666667
Cost iteration 350: 0.30045985341420567        train accuracy: 90.10416666666667
Cost iteration 360: 0.29792366098106027        train accuracy: 90.36458333333334
Cost iteration 370: 0.2954667364389266        train accuracy: 90.88541666666667
Cost iteration 380: 0.293084883495203        train accuracy: 90.88541666666667
Cost iteration 390: 0.29077424095128956        train accuracy: 91.14583333333334
Cost iteration 400: 0.2885312466030957        train accuracy: 91.14583333333334
Cost iteration 410: 0.2863526059104077        train accuracy: 91.14583333333334
Cost iteration 420: 0.28423526470570126        train accuracy: 91.40625
Cost iteration 430: 0.2821763853382611        train accuracy: 91.40625
Cost iteration 440: 0.28017332575104315        train accuracy: 91.40625
Cost iteration 450: 0.27822362107042065        train accuracy: 91.40625
Cost iteration 460: 0.2763249673566566        train accuracy: 91.66666666666667
Cost iteration 470: 0.2744752072185793        train accuracy: 91.92708333333334
Cost iteration 480: 0.2726723170418569        train accuracy: 91.92708333333334
Cost iteration 490: 0.2709143956183083        train accuracy: 91.92708333333334
Cost iteration 500: 0.26919965399535933        train accuracy: 91.92708333333334
Cost iteration 510: 0.267526406391173        train accuracy: 91.92708333333334
Cost iteration 520: 0.26589306204315283        train accuracy: 91.92708333333334
Cost iteration 530: 0.264298117876133        train accuracy: 91.66666666666667
Cost iteration 540: 0.26274015189231037        train accuracy: 91.92708333333334
```

```
Cost iteration 550: 0.261217817198262        train accuracy: 91.92708333333334
--------------------------------------------------------------------------------
Cost iteration 560: 0.2597298365957163        train accuracy: 91.92708333333334
--------------------------------------------------------------------------------
Cost iteration 570: 0.2582749976723496        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 580: 0.25685214833711933        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 590: 0.255460192751679        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 600: 0.2540980876154668        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 610: 0.252764838767283        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 620: 0.2514594980706384        train accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 630: 0.25018116055408246        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 640: 0.24892896178106108        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 650: 0.24770207542680778        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 660: 0.24649971104232304        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 670: 0.2453211119877166        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 680: 0.24416555351915714        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 690: 0.24303234101536678        train accuracy: 93.22916666666667
--------------------------------------------------------------------------------
Cost iteration 700: 0.24192080833111546        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 710: 0.24083031626648027        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 720: 0.23976025114180635        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 730: 0.2387100234693307        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 740: 0.23767906671335404        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 750: 0.23666683613162853        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 760: 0.235672807691365        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 770: 0.23469647705390007        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 780: 0.23373735862261086        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 790: 0.2327949846491966        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 800: 0.2318689043938757        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 810: 0.23095868333546724        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 820: 0.2300639024276761        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 830: 0.22918415739823422        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 840: 0.22831905808783592        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 850: 0.2274682278260693        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 860: 0.226631302841787        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 870: 0.22580793170556618        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 880: 0.2249977748021028        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 890: 0.22420050383056347        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 900: 0.22341580133106867        train accuracy: 94.27083333333334
--------------------------------------------------------------------------------
Cost iteration 910: 0.22264336023563203        train accuracy: 94.53125
--------------------------------------------------------------------------------
Cost iteration 920: 0.2218828834420057        train accuracy: 94.53125
--------------------------------------------------------------------------------
Cost iteration 930: 0.2211340834090012        train accuracy: 94.53125
--------------------------------------------------------------------------------
Cost iteration 940: 0.22039668177196348        train accuracy: 94.53125
--------------------------------------------------------------------------------
Cost iteration 950: 0.21967040897717674        train accuracy: 94.53125
```

```
Cost iteration 960: 0.21895500393406178        train accuracy: 94.53125
Cost iteration 970: 0.2182502136841178        train accuracy: 94.53125
Cost iteration 980: 0.21755579308562872        train accuracy: 94.27083333333334
Cost iteration 990: 0.2168715045132278        train accuracy: 94.27083333333334
Cost iteration 1000: 0.2161971175714662        train accuracy: 94.27083333333334
```

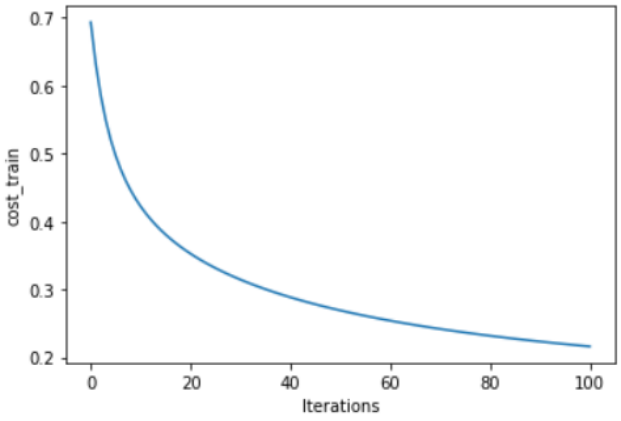
- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

```
Cost iteration 0: 0.6865354024782855        test accuracy: 79.16666666666667
Cost iteration 10: 0.6291546786105271        test accuracy: 80.20833333333334
Cost iteration 20: 0.5845395749860296        test accuracy: 80.20833333333334
Cost iteration 30: 0.5491699686752869        test accuracy: 81.25
Cost iteration 40: 0.5205444587162176        test accuracy: 82.29166666666667
Cost iteration 50: 0.49691134442917556        test accuracy: 83.33333333333334
Cost iteration 60: 0.47704089225276114        test accuracy: 83.33333333333334
Cost iteration 70: 0.4600600393265024        test accuracy: 83.33333333333334
Cost iteration 80: 0.4453393799053006        test accuracy: 83.33333333333334
Cost iteration 90: 0.43241746848125634        test accuracy: 83.33333333333334
Cost iteration 100: 0.42095020880617084        test accuracy: 83.33333333333334
Cost iteration 110: 0.4106767596311381        test accuracy: 83.33333333333334
Cost iteration 120: 0.4013962872629666        test accuracy: 83.33333333333334
Cost iteration 130: 0.39295188793607966        test accuracy: 83.33333333333334
Cost iteration 140: 0.3852193021880155        test accuracy: 83.33333333333334
Cost iteration 150: 0.3780988746221413        test accuracy: 85.41666666666667
Cost iteration 160: 0.37150974273623105        test accuracy: 86.45833333333334
Cost iteration 170: 0.36538557862407256        test accuracy: 86.45833333333334
Cost iteration 180: 0.359671427609791        test accuracy: 86.45833333333334
Cost iteration 190: 0.3543213321821862        test accuracy: 87.5
Cost iteration 200: 0.3492965253550953        test accuracy: 87.5
Cost iteration 210: 0.34456404195592194        test accuracy: 87.5
Cost iteration 220: 0.34009564018680083        test accuracy: 88.54166666666667
Cost iteration 230: 0.33586695604070194        test accuracy: 88.54166666666667
Cost iteration 240: 0.3318568342656112        test accuracy: 88.54166666666667
Cost iteration 250: 0.3280467944820693        test accuracy: 88.54166666666667
Cost iteration 260: 0.32442060171113374        test accuracy: 88.54166666666667
Cost iteration 270: 0.3209639182597399        test accuracy: 88.54166666666667
Cost iteration 280: 0.3176640195184232        test accuracy: 89.58333333333334
Cost iteration 290: 0.31450956035554223        test accuracy: 89.58333333333334
Cost iteration 300: 0.3114903818602634        test accuracy: 89.58333333333334
Cost iteration 310: 0.30859735048617226        test accuracy: 91.66666666666667
```

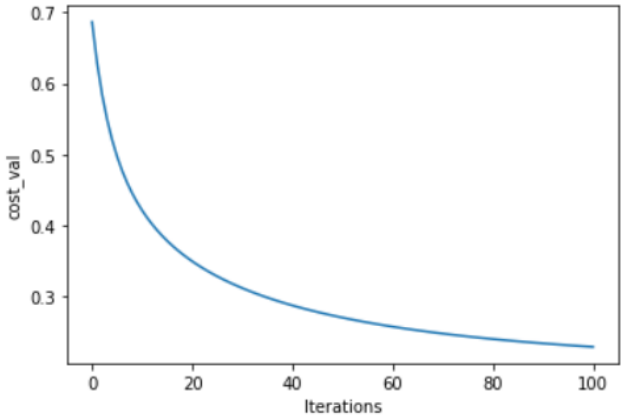
```
Cost iteration 320: 0.3058222233851624        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 330: 0.30315753504483367        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 340: 0.3005965013582667        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 350: 0.29813293803993257        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 360: 0.2957611909121943        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 370: 0.2934760760651165        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 380: 0.2912728282691384        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 390: 0.2891470563188993        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 400: 0.28709470422461636        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 410: 0.28511201735829317        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 420: 0.2831955128158086        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 430: 0.2813419533804667        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 440: 0.27954832457491297        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 450: 0.2778118143711468        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 460: 0.2761297951963764        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 470: 0.27449980792854156        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 480: 0.2729195476217786        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 490: 0.2713868507407113        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 500: 0.2698996837146721        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 510: 0.2684561326499628        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 520: 0.26705439406094966        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 530: 0.26569276649993756        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 540: 0.2643696429819741        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 550: 0.26308350411449455        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 560: 0.26183291185344165        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 570: 0.260616503817511        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 580: 0.25943298810075        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 590: 0.2582811385311233        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 600: 0.25715979032899844        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 610: 0.25606783612500583        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 620: 0.2550042223014752        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 630: 0.2539679456257816        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 640: 0.25295805014752293        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 650: 0.2519736243345911        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 660: 0.25101379842592936        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 670: 0.250077741981177        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 680: 0.24916466160950604        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 690: 0.24827379886180845        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 700: 0.24740442827202908        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 710: 0.24655585553488135        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 720: 0.24572741580845892        test accuracy: 90.625
```

```
Cost iteration 730: 0.24491847213139456        test accuracy: 90.625
Cost iteration 740: 0.24412841394521548        test accuracy: 90.625
Cost iteration 750: 0.2433566557134446        test accuracy: 90.625
Cost iteration 760: 0.2426026356297944        test accuracy: 90.625
Cost iteration 770: 0.24186581440850535        test accuracy: 90.625
Cost iteration 780: 0.241145674150528        test accuracy: 90.625
Cost iteration 790: 0.24044171727980534        test accuracy: 90.625
Cost iteration 800: 0.2397534655444336        test accuracy: 90.625
Cost iteration 810: 0.23908045907793057        test accuracy: 90.625
Cost iteration 820: 0.23842225551625834        test accuracy: 90.625
Cost iteration 830: 0.23777842916661796        test accuracy: 90.625
Cost iteration 840: 0.2371485702243639        test accuracy: 90.625
Cost iteration 850: 0.23653228403470172        test accuracy: 90.625
Cost iteration 860: 0.23592919039608812        test accuracy: 89.58333333333334
Cost iteration 870: 0.23533892290252037        test accuracy: 89.58333333333334
Cost iteration 880: 0.23476112832211044        test accuracy: 89.58333333333334
Cost iteration 890: 0.23419546600955626        test accuracy: 89.58333333333334
Cost iteration 900: 0.2336416073502983        test accuracy: 89.58333333333334
Cost iteration 910: 0.23309923523432777        test accuracy: 89.58333333333334
Cost iteration 920: 0.23256804355775995        test accuracy: 89.58333333333334
Cost iteration 930: 0.23204773675043092        test accuracy: 89.58333333333334
Cost iteration 940: 0.2315380293279049        test accuracy: 89.58333333333334
Cost iteration 950: 0.2310386454663912        test accuracy: 89.58333333333334
Cost iteration 960: 0.23054931859918737        test accuracy: 89.58333333333334
Cost iteration 970: 0.230069791033355        test accuracy: 89.58333333333334
Cost iteration 980: 0.22959981358542847        test accuracy: 89.58333333333334
Cost iteration 990: 0.22913914523504386        test accuracy: 89.58333333333334
Cost iteration 1000: 0.22868755279544387        test accuracy: 89.58333333333334
```

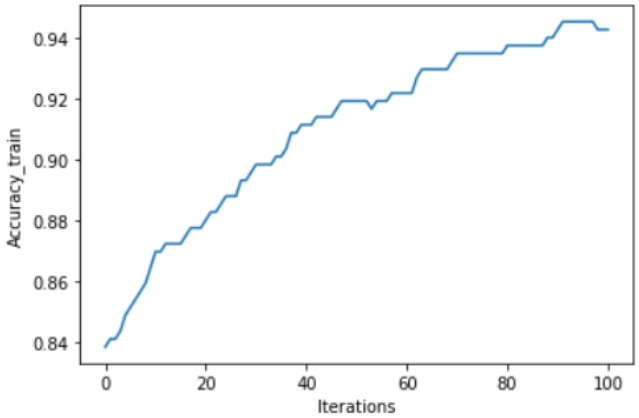
- **نمودار تغییر Loss مجموعه آموزش**



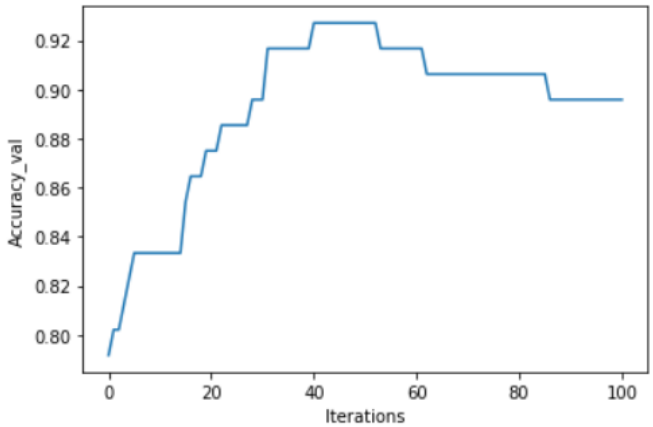
- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**



- **تعداد لایه=3:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 0.6931471805599467        train accuracy: 72.39583333333333
-------------------------------------------------------------------------------
Cost iteration 10: 0.6882488004441849        train accuracy: 72.39583333333333
-------------------------------------------------------------------------------
Cost iteration 20: 0.6835895772859752        train accuracy: 72.39583333333333
-------------------------------------------------------------------------------
Cost iteration 30: 0.6791577573415594        train accuracy: 72.39583333333333
-------------------------------------------------------------------------------
Cost iteration 40: 0.6749421226199523        train accuracy: 72.39583333333333
-------------------------------------------------------------------------------
Cost iteration 50: 0.6709319742140873        train accuracy: 72.39583333333333
-------------------------------------------------------------------------------
Cost iteration 60: 0.6671171149994592        train accuracy: 72.39583333333333
-------------------------------------------------------------------------------
```

```
Cost iteration 70: 0.6634878319049347        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 80: 0.6600348779340649        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 90: 0.6567494540908319        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 100: 0.653623191342058        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 110: 0.650648132728284        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 120: 0.6478167157173367        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 130: 0.645121754878447        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 140: 0.6425564249406588        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 150: 0.640114244286608        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 160: 0.6377890589216392        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 170: 0.6355750269486312        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 180: 0.6334666035704857        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 190: 0.6314585266348347        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 200: 0.6295458027297206        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 210: 0.6277236938332211        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 220: 0.6259877045160145        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 230: 0.6243335696918717        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 240: 0.6227572429081153        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 250: 0.6212548851654764        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 260: 0.61982285425508        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 270: 0.6184576945981544        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 280: 0.6171561275734558        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 290: 0.6159150423160289        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 300: 0.6147314869705771        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 310: 0.6136026603822684        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 320: 0.6125259042074161        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 330: 0.6114986954267604        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 340: 0.6105186392439806        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 350: 0.6095834623522116        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 360: 0.60869100655187        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 370: 0.6078392227032976        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 380: 0.6070261649981767        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 390: 0.606249985534303        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 400: 0.6055089291785726        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 410: 0.6048013287038052        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 420: 0.6041256001854334        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 430: 0.6034802386446703        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 440: 0.6028638139253875        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 450: 0.6022749667924581        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 460: 0.6017124052398011        train accuracy: 72.39583333333333
--------------------------------------------------------------------------------
Cost iteration 470: 0.60117490099703        train accuracy: 72.39583333333333
```

```
Cost iteration 480: 0.600661286224044        train accuracy: 72.39583333333333
Cost iteration 490: 0.600170450383535        train accuracy: 72.39583333333333
Cost iteration 500: 0.5997013372815927        train accuracy: 72.39583333333333
Cost iteration 510: 0.5992529422675618        train accuracy: 72.39583333333333
Cost iteration 520: 0.5988243095842352        train accuracy: 72.39583333333333
Cost iteration 530: 0.598414529860366        train accuracy: 72.39583333333333
Cost iteration 540: 0.5980227377375499        train accuracy: 72.39583333333333
Cost iteration 550: 0.5976481096242467        train accuracy: 72.39583333333333
Cost iteration 560: 0.597289861569881        train accuracy: 72.39583333333333
Cost iteration 570: 0.5969472472524158        train accuracy: 72.39583333333333
Cost iteration 580: 0.5966195560732271        train accuracy: 72.39583333333333
Cost iteration 590: 0.5963061113533131        train accuracy: 72.39583333333333
Cost iteration 600: 0.5960062686252469        train accuracy: 72.39583333333333
Cost iteration 610: 0.5957194140156788        train accuracy: 72.39583333333333
Cost iteration 620: 0.5954449627133145        train accuracy: 72.39583333333333
Cost iteration 630: 0.5951823575177023        train accuracy: 72.39583333333333
Cost iteration 640: 0.594931067464465        train accuracy: 72.39583333333333
Cost iteration 650: 0.5946905865226413        train accuracy: 72.39583333333333
Cost iteration 660: 0.5944604323602367        train accuracy: 72.39583333333333
Cost iteration 670: 0.5942401451743415        train accuracy: 72.39583333333333
Cost iteration 680: 0.5940292865821026        train accuracy: 72.39583333333333
Cost iteration 690: 0.5938274385694173        train accuracy: 72.39583333333333
Cost iteration 700: 0.5936342024940469        train accuracy: 72.39583333333333
Cost iteration 710: 0.5934491981402452        train accuracy: 72.39583333333333
Cost iteration 720: 0.5932720628221806        train accuracy: 72.39583333333333
Cost iteration 730: 0.5931024505333716        train accuracy: 72.39583333333333
Cost iteration 740: 0.5929400311397177        train accuracy: 72.39583333333333
Cost iteration 750: 0.5927844896137903        train accuracy: 72.39583333333333
Cost iteration 760: 0.5926355253081532        train accuracy: 72.39583333333333
Cost iteration 770: 0.5924928512655302        train accuracy: 72.39583333333333
Cost iteration 780: 0.5923561935639988        train accuracy: 72.39583333333333
Cost iteration 790: 0.5922252906952253        train accuracy: 72.39583333333333
Cost iteration 800: 0.5920998929739929        train accuracy: 72.39583333333333
Cost iteration 810: 0.5919797619773887        train accuracy: 72.39583333333333
Cost iteration 820: 0.5918646700120922        train accuracy: 72.39583333333333
Cost iteration 830: 0.591754399608192        train accuracy: 72.39583333333333
Cost iteration 840: 0.591648743038295        train accuracy: 72.39583333333333
Cost iteration 850: 0.5915475018603704        train accuracy: 72.39583333333333
Cost iteration 860: 0.5914504864832961        train accuracy: 72.39583333333333
Cost iteration 870: 0.5913575157538074        train accuracy: 72.39583333333333
```

```
Cost iteration 880: 0.591268416563768        train accuracy: 72.39583333333333
Cost iteration 890: 0.5911830234766758        train accuracy: 72.39583333333333
Cost iteration 900: 0.5911011783724465        train accuracy: 72.39583333333333
Cost iteration 910: 0.5910227301095098        train accuracy: 72.39583333333333
Cost iteration 920: 0.5909475342033405        train accuracy: 72.39583333333333
Cost iteration 930: 0.5908754525205319        train accuracy: 72.39583333333333
Cost iteration 940: 0.590806352987694        train accuracy: 72.39583333333333
Cost iteration 950: 0.5907401093143658        train accuracy: 72.39583333333333
Cost iteration 960: 0.590676600729233        train accuracy: 72.39583333333333
Cost iteration 970: 0.5906157117289461        train accuracy: 72.39583333333333
Cost iteration 980: 0.5905573318390668        train accuracy: 72.39583333333333
Cost iteration 990: 0.5905013553862252        train accuracy: 72.39583333333333
Cost iteration 1000: 0.5904476812812518        train accuracy: 72.39583333333333
```

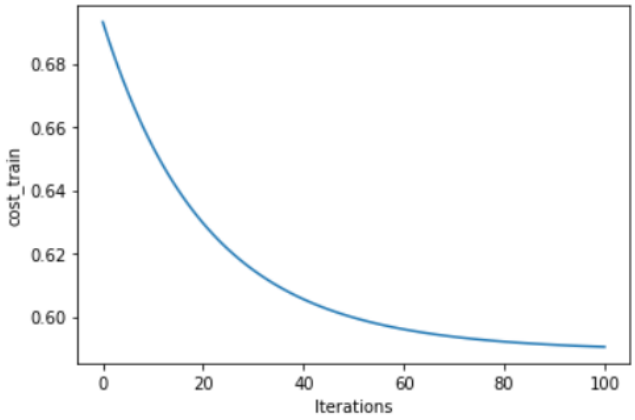
- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

```
Cost after iteration 0: 0.6925179247140014        test accuracy: 78.125
Cost after iteration 10: 0.6863784206928282        test accuracy: 78.125
Cost after iteration 20: 0.6805081549526878        test accuracy: 78.125
Cost after iteration 30: 0.6748946438689425        test accuracy: 78.125
Cost after iteration 40: 0.6695259515469411        test accuracy: 78.125
Cost after iteration 50: 0.6643906736699502        test accuracy: 78.125
Cost after iteration 60: 0.6594779206272907        test accuracy: 78.125
Cost after iteration 70: 0.6547773001344461        test accuracy: 78.125
Cost after iteration 80: 0.650278899530155        test accuracy: 78.125
Cost after iteration 90: 0.6459732679111039        test accuracy: 78.125
Cost after iteration 100: 0.6418513982422744        test accuracy: 78.125
Cost after iteration 110: 0.6379047095608659        test accuracy: 78.125
Cost after iteration 120: 0.6341250293732034        test accuracy: 78.125
Cost after iteration 130: 0.6305045763277478        test accuracy: 78.125
Cost after iteration 140: 0.6270359432326473        test accuracy: 78.125
Cost after iteration 150: 0.6237120804733469        test accuracy: 78.125
Cost after iteration 160: 0.6205262798742976        test accuracy: 78.125
Cost after iteration 170: 0.6174721590389631        test accuracy: 78.125
Cost after iteration 180: 0.614543646193436        test accuracy: 78.125
Cost after iteration 190: 0.6117349655516292        test accuracy: 78.125
Cost after iteration 200: 0.6090406232134251        test accuracy: 78.125
Cost after iteration 210: 0.6064553936016981        test accuracy: 78.125
Cost after iteration 220: 0.603974306439395        test accuracy: 78.125
Cost after iteration 230: 0.6015926342639839        test accuracy: 78.125
```

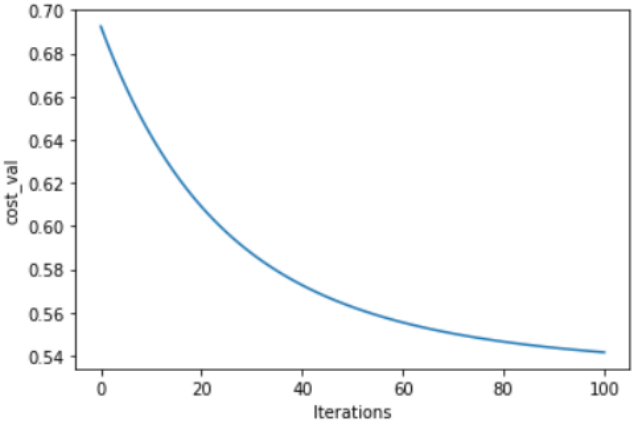
```
Cost after iteration 240: 0.5993058804732185        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 250: 0.5971097678935724        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 260: 0.5950002278603943        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 270: 0.5929733897971693        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 280: 0.5910255712798695        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 290: 0.5891532685713147        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 300: 0.5873531476098002        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 310: 0.58562203543559        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 320: 0.5839569120387392        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 330: 0.582354902611437        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 340: 0.5808132701881337        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 350: 0.5793294086568757        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 360: 0.5779008361254272        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 370: 0.5765251886261551        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 380: 0.5752002141439463        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 390: 0.5739237669519375        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 400: 0.5726938022402233        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 410: 0.5715083710232476        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 420: 0.5703656153121037        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 430: 0.569263763538442        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 440: 0.5682011262172622        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 450: 0.5671760918363773        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 460: 0.5661871229608819        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 470: 0.5652327525414519        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 480: 0.5643115804158089        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 490: 0.5634222699932664        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 500: 0.5625635451126222        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 510: 0.5617341870642676        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 520: 0.5609330317677328        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 530: 0.5601589670964301        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 540: 0.5594109303416841        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 550: 0.5586879058085923        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 560: 0.5579889225366673        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 570: 0.557313052138527        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 580: 0.556659406750314        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 590: 0.5560271370877977        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 600: 0.5554154306025197        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 610: 0.5548235097325627        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 620: 0.5542506302428778        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 630: 0.5536960796503387        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 640: 0.5531591757290019        test accuracy: 78.125
```

```
Cost after iteration 650: 0.5526392650912342        test accuracy: 78.125
Cost after iteration 660: 0.5521357218406757        test accuracy: 78.125
Cost after iteration 670: 0.5516479462931723        test accuracy: 78.125
Cost after iteration 680: 0.551175363762073        test accuracy: 78.125
Cost after iteration 690: 0.5507174234044252        test accuracy: 78.125
Cost after iteration 700: 0.5502735971248645        test accuracy: 78.125
Cost after iteration 710: 0.5498433785341134        test accuracy: 78.125
Cost after iteration 720: 0.5494262819591865        test accuracy: 78.125
Cost after iteration 730: 0.549021841502604        test accuracy: 78.125
Cost after iteration 740: 0.5486296101479875        test accuracy: 78.125
Cost after iteration 750: 0.5482491589096244        test accuracy: 78.125
Cost after iteration 760: 0.5478800760236882        test accuracy: 78.125
Cost after iteration 770: 0.5475219661789127        test accuracy: 78.125
Cost after iteration 780: 0.5471744497847072        test accuracy: 78.125
Cost after iteration 790: 0.5468371622747157        test accuracy: 78.125
Cost after iteration 800: 0.5465097534439997        test accuracy: 78.125
Cost after iteration 810: 0.5461918868181157        test accuracy: 78.125
Cost after iteration 820: 0.5458832390524213        test accuracy: 78.125
Cost after iteration 830: 0.5455834993600727        test accuracy: 78.125
Cost after iteration 840: 0.5452923689672283        test accuracy: 78.125
Cost after iteration 850: 0.5450095605940741        test accuracy: 78.125
Cost after iteration 860: 0.5447347979603505        test accuracy: 78.125
Cost after iteration 870: 0.5444678153141568        test accuracy: 78.125
Cost after iteration 880: 0.5442083569828164        test accuracy: 78.125
Cost after iteration 890: 0.5439561769447179        test accuracy: 78.125
Cost after iteration 900: 0.5437110384210859        test accuracy: 78.125
Cost after iteration 910: 0.5434727134866404        test accuracy: 78.125
Cost after iteration 920: 0.5432409826982499        test accuracy: 78.125
Cost after iteration 930: 0.5430156347406518        test accuracy: 78.125
Cost after iteration 940: 0.5427964660883964        test accuracy: 78.125
Cost after iteration 950: 0.5425832806832359        test accuracy: 78.125
Cost after iteration 960: 0.542375889626154        test accuracy: 78.125
Cost after iteration 970: 0.5421741108833672        test accuracy: 78.125
Cost after iteration 980: 0.541977769005568        test accuracy: 78.125
Cost after iteration 990: 0.5417866948598093        test accuracy: 78.125
Cost after iteration 1000: 0.5416007253733734        test accuracy: 78.125
```

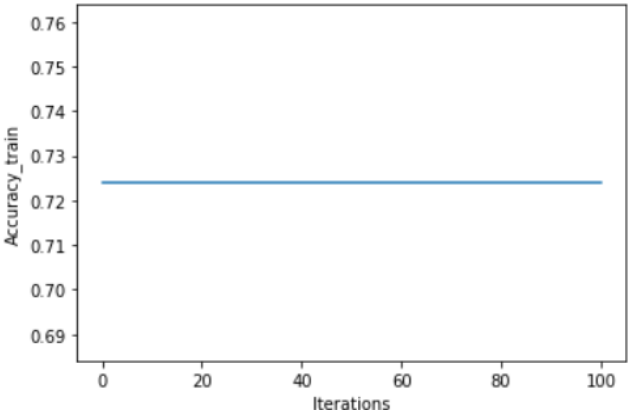
- **نمودار تغییر Loss مجموعه آموزش**



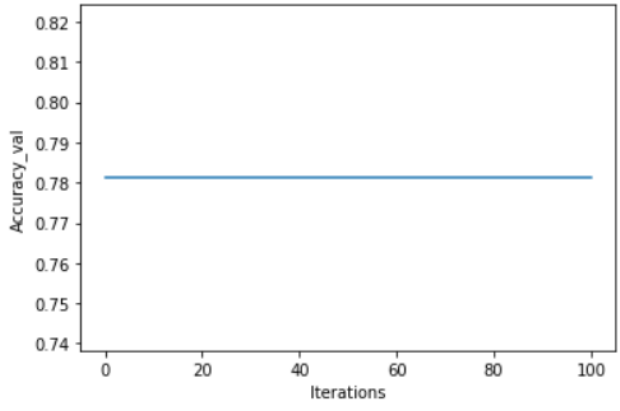
- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**



- **تعداد لایه=5:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 0.6931471805599467        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 10: 0.6882488004441849        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 20: 0.6835895772859752        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 30: 0.6791577573415594        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 40: 0.6749421226199523        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 50: 0.6709319742140873        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 60: 0.6671171149994592        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 70: 0.6634878319049347        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 80: 0.6600348779340649        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 90: 0.6567494540908319        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 100: 0.653623191342058        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 110: 0.650648132728284        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 120: 0.6478167157173367        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 130: 0.645121754878447        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 140: 0.6425564249406588        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 150: 0.640114244286608        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 160: 0.6377890589216392        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 170: 0.6355750269486312        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 180: 0.6334666035704857        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 190: 0.6314585266348347        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 200: 0.6295458027297206        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 210: 0.6277236938332211        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 220: 0.6259877045160145        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 230: 0.6243335696918717        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 240: 0.6227572429081153        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 250: 0.6212548851654764        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 260: 0.61982285425508        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 270: 0.6184576945981544        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 280: 0.6171561275734558        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 290: 0.6159150423160289        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 300: 0.6147314869705771        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 310: 0.6136026603822684        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 320: 0.6125259042074161        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 330: 0.6114986954267604        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 340: 0.6105186392439806        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 350: 0.6095834623522116        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 360: 0.60869100655187        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 370: 0.6078392227032976        train accuracy: 72.39583333333333
-----------------------------------------------------------------------------
Cost iteration 380: 0.6070261649981767        train accuracy: 72.39583333333333
```

```
Cost iteration 390: 0.606249985534303        train accuracy: 72.39583333333333
Cost iteration 400: 0.6055089291785726        train accuracy: 72.39583333333333
Cost iteration 410: 0.6048013287038052        train accuracy: 72.39583333333333
Cost iteration 420: 0.6041256001854334        train accuracy: 72.39583333333333
Cost iteration 430: 0.6034802386446703        train accuracy: 72.39583333333333
Cost iteration 440: 0.6028638139253875        train accuracy: 72.39583333333333
Cost iteration 450: 0.6022749667924581        train accuracy: 72.39583333333333
Cost iteration 460: 0.6017124052398011        train accuracy: 72.39583333333333
Cost iteration 470: 0.60117490099703        train accuracy: 72.39583333333333
Cost iteration 480: 0.600661286224044        train accuracy: 72.39583333333333
Cost iteration 490: 0.600170450383535        train accuracy: 72.39583333333333
Cost iteration 500: 0.5997013372815927        train accuracy: 72.39583333333333
Cost iteration 510: 0.5992529422675618        train accuracy: 72.39583333333333
Cost iteration 520: 0.5988243095842352        train accuracy: 72.39583333333333
Cost iteration 530: 0.598414529860366        train accuracy: 72.39583333333333
Cost iteration 540: 0.5980227377375499        train accuracy: 72.39583333333333
Cost iteration 550: 0.5976481096242467        train accuracy: 72.39583333333333
Cost iteration 560: 0.597289861569881        train accuracy: 72.39583333333333
Cost iteration 570: 0.5969472472524158        train accuracy: 72.39583333333333
Cost iteration 580: 0.5966195560732271        train accuracy: 72.39583333333333
Cost iteration 590: 0.5963061113533131        train accuracy: 72.39583333333333
Cost iteration 600: 0.5960062686252469        train accuracy: 72.39583333333333
Cost iteration 610: 0.5957194140156788        train accuracy: 72.39583333333333
Cost iteration 620: 0.5954449627133145        train accuracy: 72.39583333333333
Cost iteration 630: 0.5951823575177023        train accuracy: 72.39583333333333
Cost iteration 640: 0.594931067464465        train accuracy: 72.39583333333333
Cost iteration 650: 0.5946905865226413        train accuracy: 72.39583333333333
Cost iteration 660: 0.5944604323602367        train accuracy: 72.39583333333333
Cost iteration 670: 0.5942401451743415        train accuracy: 72.39583333333333
Cost iteration 680: 0.5940292865821026        train accuracy: 72.39583333333333
Cost iteration 690: 0.5938274385694173        train accuracy: 72.39583333333333
Cost iteration 700: 0.5936342024940469        train accuracy: 72.39583333333333
Cost iteration 710: 0.5934491981402452        train accuracy: 72.39583333333333
Cost iteration 720: 0.5932720628221806        train accuracy: 72.39583333333333
Cost iteration 730: 0.5931024505333716        train accuracy: 72.39583333333333
Cost iteration 740: 0.5929400311397177        train accuracy: 72.39583333333333
Cost iteration 750: 0.5927844896137903        train accuracy: 72.39583333333333
Cost iteration 760: 0.5926355253081532        train accuracy: 72.39583333333333
Cost iteration 770: 0.5924928512655302        train accuracy: 72.39583333333333
Cost iteration 780: 0.5923561935639988        train accuracy: 72.39583333333333
```

```
Cost iteration 790: 0.5922252906952253        train accuracy: 72.39583333333333
Cost iteration 800: 0.5920998929739929        train accuracy: 72.39583333333333
Cost iteration 810: 0.5919797619773887        train accuracy: 72.39583333333333
Cost iteration 820: 0.5918646700120922        train accuracy: 72.39583333333333
Cost iteration 830: 0.591754399608192        train accuracy: 72.39583333333333
Cost iteration 840: 0.591648743038295        train accuracy: 72.39583333333333
Cost iteration 850: 0.5915475018603704        train accuracy: 72.39583333333333
Cost iteration 860: 0.5914504864832961        train accuracy: 72.39583333333333
Cost iteration 870: 0.5913575157538074        train accuracy: 72.39583333333333
Cost iteration 880: 0.591268416563768        train accuracy: 72.39583333333333
Cost iteration 890: 0.5911830234766758        train accuracy: 72.39583333333333
Cost iteration 900: 0.5911011783724465        train accuracy: 72.39583333333333
Cost iteration 910: 0.5910227301095098        train accuracy: 72.39583333333333
Cost iteration 920: 0.5909475342033405        train accuracy: 72.39583333333333
Cost iteration 930: 0.5908754525205319        train accuracy: 72.39583333333333
Cost iteration 940: 0.590806352987694        train accuracy: 72.39583333333333
Cost iteration 950: 0.5907401093143658        train accuracy: 72.39583333333333
Cost iteration 960: 0.590676600729233        train accuracy: 72.39583333333333
Cost iteration 970: 0.5906157117289461        train accuracy: 72.39583333333333
Cost iteration 980: 0.5905573318390668        train accuracy: 72.39583333333333
Cost iteration 990: 0.5905013553862252        train accuracy: 72.39583333333333
Cost iteration 1000: 0.5904476812812518        train accuracy: 72.39583333333333
```

- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

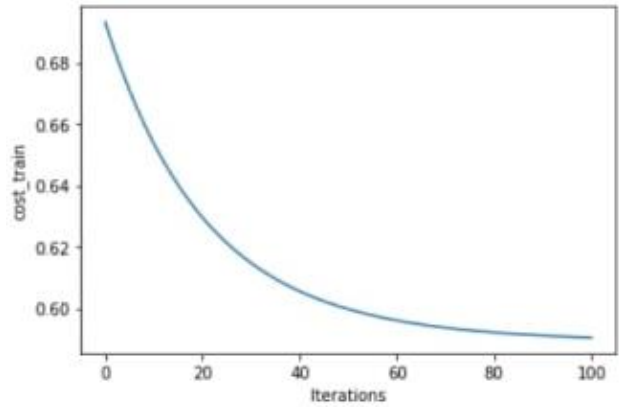
```
Cost after iteration 0: 0.6925179247140014        test accuracy: 78.125
Cost after iteration 10: 0.6863784206928282        test accuracy: 78.125
Cost after iteration 20: 0.6805081549526878        test accuracy: 78.125
Cost after iteration 30: 0.6748946438689425        test accuracy: 78.125
Cost after iteration 40: 0.6695259515469411        test accuracy: 78.125
Cost after iteration 50: 0.6643906736699502        test accuracy: 78.125
Cost after iteration 60: 0.6594779206272907        test accuracy: 78.125
Cost after iteration 70: 0.6547773001344461        test accuracy: 78.125
Cost after iteration 80: 0.650278899530155        test accuracy: 78.125
Cost after iteration 90: 0.6459732679111039        test accuracy: 78.125
Cost after iteration 100: 0.6418513982422744        test accuracy: 78.125
Cost after iteration 110: 0.6379047095608659        test accuracy: 78.125
Cost after iteration 120: 0.6341250293732034        test accuracy: 78.125
Cost after iteration 130: 0.6305045763277478        test accuracy: 78.125
Cost after iteration 140: 0.6270359432326473        test accuracy: 78.125
```

```
Cost after iteration 150: 0.6237120804733469        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 160: 0.6205262798742976        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 170: 0.6174721590389631        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 180: 0.614543646193436        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 190: 0.6117349655516292        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 200: 0.6090406232134251        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 210: 0.6064553936016981        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 220: 0.603974306439395        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 230: 0.6015926342639839        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 240: 0.5993058804732185        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 250: 0.5971097678935724        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 260: 0.5950002278603943        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 270: 0.5929733897971693        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 280: 0.5910255712798695        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 290: 0.5891532685713147        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 300: 0.5873531476098002        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 310: 0.58562203543559        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 320: 0.5839569120387392        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 330: 0.582354902611437        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 340: 0.5808132701881337        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 350: 0.5793294086568757        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 360: 0.5779008361254272        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 370: 0.5765251886261551        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 380: 0.5752002141439463        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 390: 0.5739237669519375        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 400: 0.5726938022402233        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 410: 0.5715083710232476        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 420: 0.5703656153121037        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 430: 0.569263763538442        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 440: 0.5682011262172622        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 450: 0.5671760918363773        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 460: 0.5661871229608819        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 470: 0.5652327525414519        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 480: 0.5643115804158089        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 490: 0.5634222699932664        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 500: 0.5625635451126222        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 510: 0.5617341870642676        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 520: 0.5609330317677328        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 530: 0.5601589670964301        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 540: 0.5594109303416841        test accuracy: 78.125
--------------------------------------------------------------------------------
Cost after iteration 550: 0.5586879058085923        test accuracy: 78.125
```

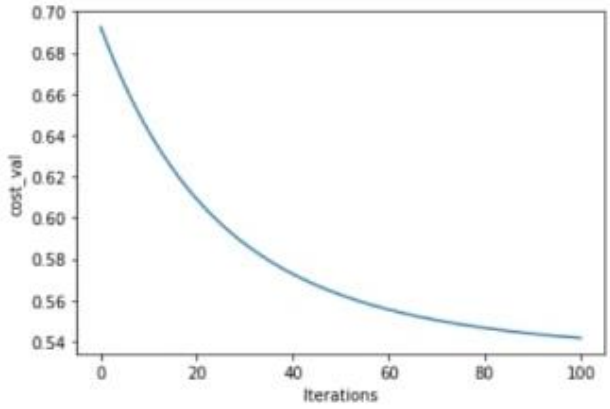
```
Cost after iteration 560: 0.5579889225366673        test accuracy: 78.125
Cost after iteration 570: 0.557313052138527        test accuracy: 78.125
Cost after iteration 580: 0.556659406750314        test accuracy: 78.125
Cost after iteration 590: 0.5560271370877977        test accuracy: 78.125
Cost after iteration 600: 0.5554154306025197        test accuracy: 78.125
Cost after iteration 610: 0.5548235097325627        test accuracy: 78.125
Cost after iteration 620: 0.5542506302428778        test accuracy: 78.125
Cost after iteration 630: 0.5536960796503387        test accuracy: 78.125
Cost after iteration 640: 0.5531591757290019        test accuracy: 78.125
Cost after iteration 650: 0.5526392650912342        test accuracy: 78.125
Cost after iteration 660: 0.5521357218406757        test accuracy: 78.125
Cost after iteration 670: 0.5516479462931723        test accuracy: 78.125
Cost after iteration 680: 0.551175363762073        test accuracy: 78.125
Cost after iteration 690: 0.5507174234044252        test accuracy: 78.125
Cost after iteration 700: 0.5502735971248645        test accuracy: 78.125
Cost after iteration 710: 0.5498433785341134        test accuracy: 78.125
Cost after iteration 720: 0.5494262819591865        test accuracy: 78.125
Cost after iteration 730: 0.549021841502604        test accuracy: 78.125
Cost after iteration 740: 0.5486296101479875        test accuracy: 78.125
Cost after iteration 750: 0.5482491589096244        test accuracy: 78.125
Cost after iteration 760: 0.5478800760236882        test accuracy: 78.125
Cost after iteration 770: 0.5475219661789127        test accuracy: 78.125
Cost after iteration 780: 0.5471744497847072        test accuracy: 78.125
Cost after iteration 790: 0.5468371622747157        test accuracy: 78.125
Cost after iteration 800: 0.5465097534439997        test accuracy: 78.125
Cost after iteration 810: 0.5461918868181157        test accuracy: 78.125
Cost after iteration 820: 0.5458832390524213        test accuracy: 78.125
Cost after iteration 830: 0.5455834993600727        test accuracy: 78.125
Cost after iteration 840: 0.5452923689672283        test accuracy: 78.125
Cost after iteration 850: 0.5450095605940741        test accuracy: 78.125
Cost after iteration 860: 0.5447347979603505        test accuracy: 78.125
Cost after iteration 870: 0.5444678153141568        test accuracy: 78.125
Cost after iteration 880: 0.5442083569828164        test accuracy: 78.125
Cost after iteration 890: 0.5439561769447179        test accuracy: 78.125
Cost after iteration 900: 0.5437110384210859        test accuracy: 78.125
Cost after iteration 910: 0.5434727134866404        test accuracy: 78.125
Cost after iteration 920: 0.5432409826982499        test accuracy: 78.125
Cost after iteration 930: 0.5430156347406518        test accuracy: 78.125
Cost after iteration 940: 0.5427964660883964        test accuracy: 78.125
Cost after iteration 950: 0.5425832806832359        test accuracy: 78.125
```

```
Cost after iteration 960: 0.542375889626154        test accuracy: 78.125
-------------------------------------------------------------------------------------------
Cost after iteration 970: 0.5421741108833672        test accuracy: 78.125
-------------------------------------------------------------------------------------------
Cost after iteration 980: 0.541977769005568        test accuracy: 78.125
-------------------------------------------------------------------------------------------
Cost after iteration 990: 0.5417866948598093        test accuracy: 78.125
-------------------------------------------------------------------------------------------
Cost after iteration 1000: 0.5416007253733734        test accuracy: 78.125
 ------------------------------------------------------------------------
                                                                 -------------
```

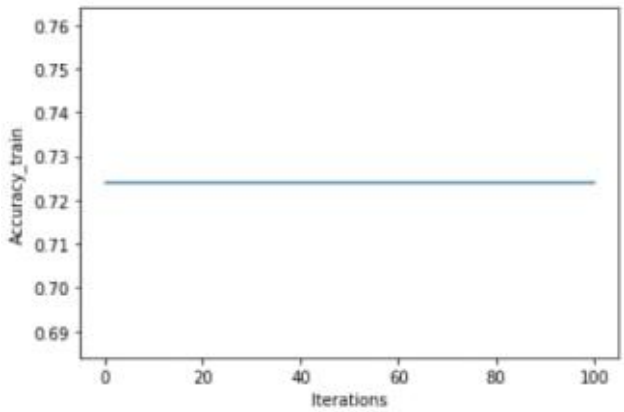
- **نمودار تغییر Loss مجموعه آموزش**



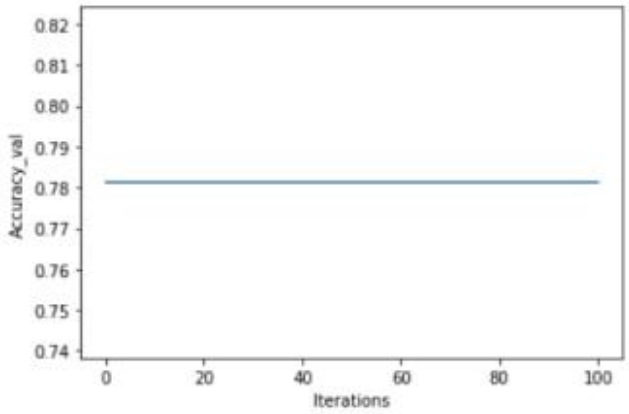
- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**



- **توضیحات تکمیلی:**
- **برای بهبود مدل برای هر مدل تعداد epochو learning rateعوض شده است. در بعضی از مدل های بهبود یافته overfittingهم وجود دارد.**
- **نتایج بهبود مدل (نمره مثبت):**

مدل	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
دو لایه-1000/0.03	0.16-95.05%	0.20-90.625%	0.16-95.05%	0.20-90.625%
سه لایه-1000/0.1	0.03-99.21%	0.16-92.70%	0.03-99.21%	0.16-92.70%
پنج لایه-600/0.1	0.01-100%	0.23-91.66%	0.01-100%	0.23-91.66%

- **تعداد لایه=2:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 1.1176089233925879        train accuracy: 38.541666666666664
---------------------------------------------------------------------------
Cost iteration 10: 0.8689509434637193        train accuracy: 49.73958333333333
---------------------------------------------------------------------------
Cost iteration 20: 0.7253416662051124        train accuracy: 60.9375
---------------------------------------------------------------------------
Cost iteration 30: 0.6356441776581208        train accuracy: 67.44791666666666
---------------------------------------------------------------------------
Cost iteration 40: 0.5740985720734253        train accuracy: 71.875
---------------------------------------------------------------------------
Cost iteration 50: 0.5284354278542501        train accuracy: 75.0
---------------------------------------------------------------------------
Cost iteration 60: 0.492543579208411        train accuracy: 76.04166666666667
---------------------------------------------------------------------------
Cost iteration 70: 0.4631517929850298        train accuracy: 77.60416666666667
---------------------------------------------------------------------------
Cost iteration 80: 0.4383741089031986        train accuracy: 79.94791666666667
---------------------------------------------------------------------------
Cost iteration 90: 0.4170458158818301        train accuracy: 82.03125
---------------------------------------------------------------------------
Cost iteration 100: 0.3984025499161954        train accuracy: 83.59375
---------------------------------------------------------------------------
Cost iteration 110: 0.38191591344091363        train accuracy: 85.15625
---------------------------------------------------------------------------
Cost iteration 120: 0.3672043965410292        train accuracy: 86.19791666666667
---------------------------------------------------------------------------
Cost iteration 130: 0.35398243787637584        train accuracy: 87.23958333333334
---------------------------------------------------------------------------
Cost iteration 140: 0.34202979353067897        train accuracy: 87.5
---------------------------------------------------------------------------
Cost iteration 150: 0.3311722659796493        train accuracy: 87.76041666666667
---------------------------------------------------------------------------
```

```
Cost iteration 160: 0.3212690993393401        train accuracy: 88.28125
--------------------------------------------------------------------------------
Cost iteration 170: 0.312204462932137        train accuracy: 88.54166666666666
--------------------------------------------------------------------------------
Cost iteration 180: 0.3038815397479838        train accuracy: 89.0625
--------------------------------------------------------------------------------
Cost iteration 190: 0.29621832745903914        train accuracy: 89.32291666666667
--------------------------------------------------------------------------------
Cost iteration 200: 0.2891445938295091        train accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 210: 0.28259962605626265        train accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 220: 0.2765305353971481        train accuracy: 89.84375
--------------------------------------------------------------------------------
Cost iteration 230: 0.2708909560920314        train accuracy: 89.84375
--------------------------------------------------------------------------------
Cost iteration 240: 0.26564002838615736        train accuracy: 90.10416666666667
--------------------------------------------------------------------------------
Cost iteration 250: 0.2607415893548366        train accuracy: 90.88541666666667
--------------------------------------------------------------------------------
Cost iteration 260: 0.2561635181511253        train accuracy: 91.40625
--------------------------------------------------------------------------------
Cost iteration 270: 0.25187719795918995        train accuracy: 91.40625
--------------------------------------------------------------------------------
Cost iteration 280: 0.24785706771690452        train accuracy: 91.92708333333334
--------------------------------------------------------------------------------
Cost iteration 290: 0.24408024413908563        train accuracy: 91.92708333333334
--------------------------------------------------------------------------------
Cost iteration 300: 0.2405261997765546        train accuracy: 92.1875
--------------------------------------------------------------------------------
Cost iteration 310: 0.23717648649592782        train accuracy: 92.44791666666667
--------------------------------------------------------------------------------
Cost iteration 320: 0.234014496344679        train accuracy: 92.44791666666667
--------------------------------------------------------------------------------
Cost iteration 330: 0.23102525360696619        train accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost iteration 340: 0.22819523318515467        train accuracy: 92.96875
--------------------------------------------------------------------------------
Cost iteration 350: 0.22551220141591968        train accuracy: 93.48958333333334
--------------------------------------------------------------------------------
Cost iteration 360: 0.222965076155248        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 370: 0.22054380351715444        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 380: 0.2182392490768854        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 390: 0.21604310168557586        train accuracy: 94.01041666666667
--------------------------------------------------------------------------------
Cost iteration 400: 0.2139477883137565        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 410: 0.21194639856239875        train accuracy: 93.75
--------------------------------------------------------------------------------
Cost iteration 420: 0.21003261766407114        train accuracy: 94.53125
--------------------------------------------------------------------------------
Cost iteration 430: 0.20820066695149697        train accuracy: 94.53125
--------------------------------------------------------------------------------
Cost iteration 440: 0.20644525090235383        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 450: 0.20476150998190257        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 460: 0.20314497860227015        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 470: 0.2015915476014628        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 480: 0.20009743071843572        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 490: 0.19865913460438583        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 500: 0.19727343196617825        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 510: 0.19593733748654432        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 520: 0.19464808620833407        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 530: 0.19340311410743793        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 540: 0.1922000406117174        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 550: 0.19103665285194718        train accuracy: 94.79166666666667
--------------------------------------------------------------------------------
Cost iteration 560: 0.18991089145592327        train accuracy: 94.79166666666667
```

```
Cost iteration 570: 0.18882083771895308        train accuracy: 94.79166666666667
Cost iteration 580: 0.18776470200329845        train accuracy: 94.79166666666667
Cost iteration 590: 0.18674081323615516        train accuracy: 94.79166666666667
Cost iteration 600: 0.18574760939068305        train accuracy: 94.79166666666667
Cost iteration 610: 0.18478362884773752        train accuracy: 94.79166666666667
Cost iteration 620: 0.18384750254750493        train accuracy: 94.79166666666667
Cost iteration 630: 0.18293794685041426        train accuracy: 94.79166666666667
Cost iteration 640: 0.18205375703565344        train accuracy: 94.79166666666667
Cost iteration 650: 0.18119380137351687        train accuracy: 94.79166666666667
Cost iteration 660: 0.1803570157147857        train accuracy: 94.79166666666667
Cost iteration 670: 0.17954239854647858        train accuracy: 94.79166666666667
Cost iteration 680: 0.17874900646877118        train accuracy: 94.79166666666667
Cost iteration 690: 0.17797595005267403        train accuracy: 94.79166666666667
Cost iteration 700: 0.17722239004233087        train accuracy: 94.79166666666667
Cost iteration 710: 0.17648753386957056        train accuracy: 94.79166666666667
Cost iteration 720: 0.17577063245169794        train accuracy: 95.05208333333334
Cost iteration 730: 0.17507097724647824        train accuracy: 95.05208333333334
Cost iteration 740: 0.17438789754092499        train accuracy: 95.05208333333334
Cost iteration 750: 0.1737207579528446        train accuracy: 95.05208333333334
Cost iteration 760: 0.17306895612619347        train accuracy: 95.05208333333334
Cost iteration 770: 0.1724319206031702        train accuracy: 95.05208333333334
Cost iteration 780: 0.1718091088576364        train accuracy: 95.05208333333334
Cost iteration 790: 0.1712000054759482        train accuracy: 95.05208333333334
Cost iteration 800: 0.17060412047261758        train accuracy: 95.3125
Cost iteration 810: 0.17002098772941493        train accuracy: 95.3125
Cost iteration 820: 0.16945016354759304        train accuracy: 95.3125
Cost iteration 830: 0.16889122530387957        train accuracy: 95.3125
Cost iteration 840: 0.168343770201739        train accuracy: 95.57291666666667
Cost iteration 850: 0.16780741411018807        train accuracy: 95.57291666666667
Cost iteration 860: 0.16728179048314476        train accuracy: 95.57291666666667
Cost iteration 870: 0.16676654935291269        train accuracy: 95.57291666666667
Cost iteration 880: 0.1662613563919858        train accuracy: 95.57291666666667
Cost iteration 890: 0.16576589203784997        train accuracy: 95.57291666666667
Cost iteration 900: 0.16527985067593826        train accuracy: 95.57291666666667
Cost iteration 910: 0.16480293987630187        train accuracy: 95.57291666666667
Cost iteration 920: 0.16433487967994634        train accuracy: 95.57291666666667
Cost iteration 930: 0.16387540193112013        train accuracy: 95.57291666666667
Cost iteration 940: 0.1634242496521528        train accuracy: 95.57291666666667
Cost iteration 950: 0.16298117645773114        train accuracy: 95.57291666666667
Cost iteration 960: 0.16254594600574498        train accuracy: 95.57291666666667
```

```
Cost iteration 970: 0.16211833148207722        train accuracy: 95.3125
--------------------------------------------------------------------------------
Cost iteration 980: 0.16169811511692447        train accuracy: 95.3125
--------------------------------------------------------------------------------
Cost iteration 990: 0.161285087730419        train accuracy: 95.3125
--------------------------------------------------------------------------------
Cost iteration 1000: 0.16087904830551325        train accuracy: 95.05208333333334
--------------------------------------------------------------------------------
```

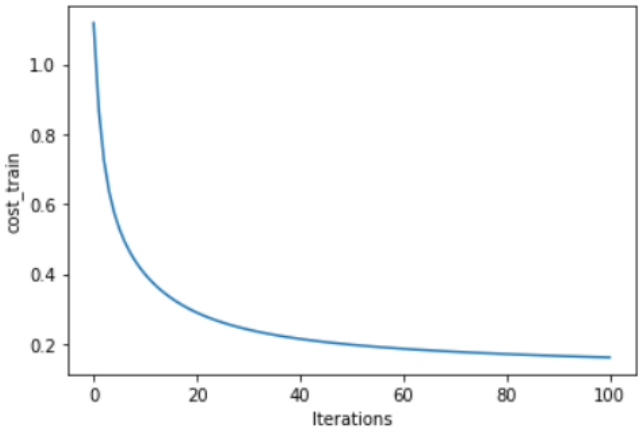
- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

```
Cost iteration 0: 1.0379100957856662        test accuracy: 40.625
--------------------------------------------------------------------------------
Cost iteration 10: 0.8096841108194252        test accuracy: 53.125
--------------------------------------------------------------------------------
Cost iteration 20: 0.6742118672590334        test accuracy: 62.5
--------------------------------------------------------------------------------
Cost iteration 30: 0.5874348729759002        test accuracy: 67.70833333333333
--------------------------------------------------------------------------------
Cost iteration 40: 0.5271205685902098        test accuracy: 71.875
--------------------------------------------------------------------------------
Cost iteration 50: 0.48236983033904296        test accuracy: 72.91666666666666
--------------------------------------------------------------------------------
Cost iteration 60: 0.4475328132348316        test accuracy: 75.0
--------------------------------------------------------------------------------
Cost iteration 70: 0.41944755206637213        test accuracy: 77.08333333333334
--------------------------------------------------------------------------------
Cost iteration 80: 0.396211783081427        test accuracy: 81.25
--------------------------------------------------------------------------------
Cost iteration 90: 0.37660840871453166        test accuracy: 83.33333333333334
--------------------------------------------------------------------------------
Cost iteration 100: 0.3598179935216893        test accuracy: 84.375
--------------------------------------------------------------------------------
Cost iteration 110: 0.3452651161057614        test accuracy: 85.41666666666667
--------------------------------------------------------------------------------
Cost iteration 120: 0.3325312704558142        test accuracy: 87.5
--------------------------------------------------------------------------------
Cost iteration 130: 0.32130290032030184        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 140: 0.3113390138784853        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 150: 0.30245024664022946        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 160: 0.2944849017231436        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 170: 0.28731939521687505        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 180: 0.28085156586046456        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 190: 0.27499589349627407        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 200: 0.2696800161181894        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 210: 0.2648421463240753        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 220: 0.26042912077855707        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 230: 0.25639490197369486        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 240: 0.2526994079896875        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 250: 0.24930758371240552        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 260: 0.24618865256267913        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 270: 0.24331550533242244        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 280: 0.24066419484895857        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 290: 0.23821351363999904        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 300: 0.2359446377082911        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 310: 0.23384082373039278        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 320: 0.23188715000152807        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 330: 0.2300702936228628        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 340: 0.22837833801942978        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
```

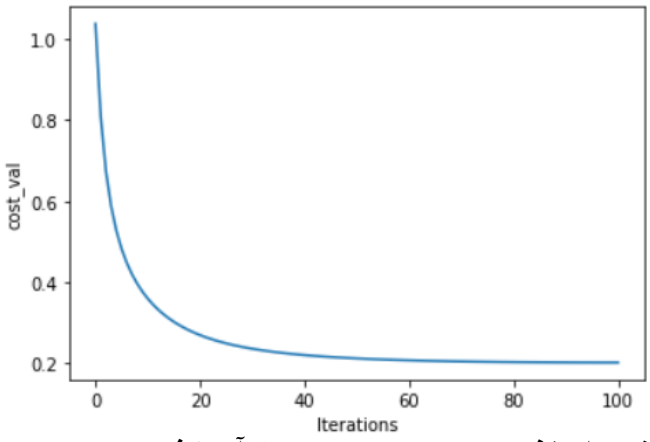
```
Cost iteration 350: 0.22680060605900654        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 360: 0.22532751493372388        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 370: 0.22395044964965363        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 380: 0.22266165250242356        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 390: 0.22145412633911765        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 400: 0.22032154974646573        test accuracy: 88.54166666666667
--------------------------------------------------------------------------------
Cost iteration 410: 0.21925820258253018        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 420: 0.21825890049808977        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 430: 0.21731893728500368        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 440: 0.21643403404971753        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 450: 0.21560029434642775        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 460: 0.2148141645206675        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 470: 0.21407239861358812        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 480: 0.2133720272627069        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 490: 0.2127103301085374        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 500: 0.21208481128008        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 510: 0.2114931775871125        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 520: 0.21093331909479623        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 530: 0.21040329179735887        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 540: 0.20990130214336938        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 550: 0.20942569319619644        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 560: 0.20897493224021416        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 570: 0.20854759966678463        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 580: 0.20814237899446986        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 590: 0.20775804789569285        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 600: 0.20739347011757087        test accuracy: 89.58333333333334
--------------------------------------------------------------------------------
Cost iteration 610: 0.20704758819815045        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 620: 0.20671941689106554        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 630: 0.20640803722194462        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 640: 0.2061125911088993        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 650: 0.20583227648730473        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 660: 0.2055663428859892        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 670: 0.20531408740800372        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 680: 0.20507485107444662        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 690: 0.20484801549449508        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 700: 0.20463299982888727        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 710: 0.20442925801772086        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 720: 0.2042362762466086        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 730: 0.20405357062804347        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 740: 0.20388068507730678        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 750: 0.2037171893644409        test accuracy: 91.66666666666667
```

```
Cost iteration 760: 0.2035626773257522        test accuracy: 91.66666666666667
Cost iteration 770: 0.20341676522002738        test accuracy: 91.66666666666667
Cost iteration 780: 0.20327909021617288        test accuracy: 91.66666666666667
Cost iteration 790: 0.2031493090003386        test accuracy: 91.66666666666667
Cost iteration 800: 0.20302709649179476        test accuracy: 91.66666666666667
Cost iteration 810: 0.20291214465790186        test accuracy: 91.66666666666667
Cost iteration 820: 0.20280416141946325        test accuracy: 91.66666666666667
Cost iteration 830: 0.20270286963861278        test accuracy: 91.66666666666667
Cost iteration 840: 0.20260800618213598        test accuracy: 91.66666666666667
Cost iteration 850: 0.2025193210538183        test accuracy: 91.66666666666667
Cost iteration 860: 0.20243657659000963        test accuracy: 90.625
Cost iteration 870: 0.20235954671315004        test accuracy: 90.625
Cost iteration 880: 0.20228801623848117        test accuracy: 90.625
Cost iteration 890: 0.20222178022961596        test accuracy: 90.625
Cost iteration 900: 0.2021606433990275        test accuracy: 90.625
Cost iteration 910: 0.2021044195498749        test accuracy: 90.625
Cost iteration 920: 0.20205293105590608        test accuracy: 90.625
Cost iteration 930: 0.20200600837646146        test accuracy: 90.625
Cost iteration 940: 0.2019634896038678        test accuracy: 90.625
Cost iteration 950: 0.20192522004074293        test accuracy: 90.625
Cost iteration 960: 0.20189105180494482        test accuracy: 90.625
Cost iteration 970: 0.20186084346009495        test accuracy: 90.625
Cost iteration 980: 0.2018344596697757        test accuracy: 90.625
Cost iteration 990: 0.20181177087366164        test accuracy: 90.625
Cost iteration 1000: 0.20179265298398924        test accuracy: 90.625
```

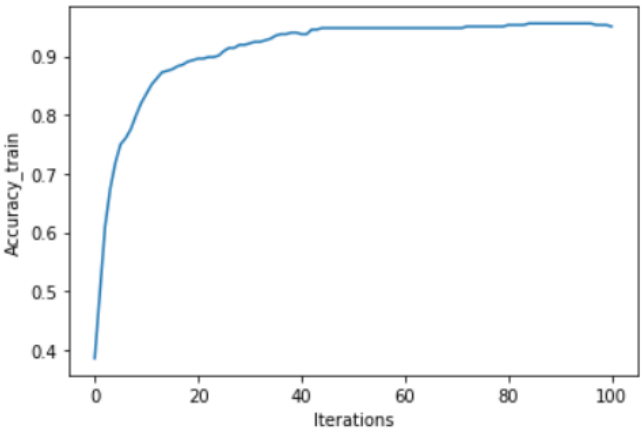
- **نمودار تغییر Loss مجموعه آموزش**



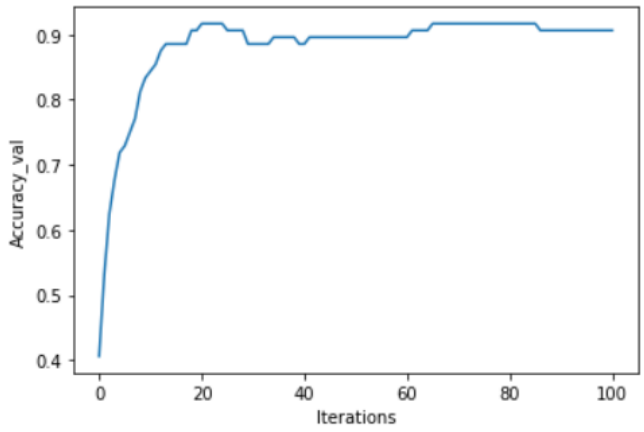
- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**



- **تعداد لایه=3:**
  - **شکل خروجی کد (Loss و Accuracy) مجموعه آموزش**

```
Cost iteration 0: 0.8769088963933341        train accuracy: 58.072916666666664
-------------------------------------------------------------------------------
Cost iteration 10: 0.38362868439623515        train accuracy: 84.375
-------------------------------------------------------------------------------
Cost iteration 20: 0.29192667614204365        train accuracy: 91.14583333333334
-------------------------------------------------------------------------------
Cost iteration 30: 0.2475551087215741        train accuracy: 91.92708333333334
-------------------------------------------------------------------------------
Cost iteration 40: 0.21996012331612863        train accuracy: 93.48958333333334
-------------------------------------------------------------------------------
Cost iteration 50: 0.20012001450861144        train accuracy: 93.48958333333334
-------------------------------------------------------------------------------
Cost iteration 60: 0.185044891312152        train accuracy: 94.53125
-------------------------------------------------------------------------------
Cost iteration 70: 0.17303221701240806        train accuracy: 94.79166666666667
-------------------------------------------------------------------------------
Cost iteration 80: 0.16315236526535565        train accuracy: 95.3125
-------------------------------------------------------------------------------
Cost iteration 90: 0.15474489331561922        train accuracy: 95.83333333333334
-------------------------------------------------------------------------------
```

```
Cost iteration 100: 0.147478244383559        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 110: 0.14114754662315376        train accuracy: 96.09375
--------------------------------------------------------------------------------
Cost iteration 120: 0.13554518808184904        train accuracy: 96.61458333333334
--------------------------------------------------------------------------------
Cost iteration 130: 0.13048153293846274        train accuracy: 96.875
--------------------------------------------------------------------------------
Cost iteration 140: 0.12591326700289743        train accuracy: 96.875
--------------------------------------------------------------------------------
Cost iteration 150: 0.1218225638172398        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 160: 0.11808197754373435        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 170: 0.11466842415121226        train accuracy: 97.13541666666667
--------------------------------------------------------------------------------
Cost iteration 180: 0.11154430661509408        train accuracy: 97.13541666666667
--------------------------------------------------------------------------------
Cost iteration 190: 0.1086248051895384        train accuracy: 97.13541666666667
--------------------------------------------------------------------------------
Cost iteration 200: 0.10591818341207732        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 210: 0.10337593680320195        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 220: 0.10099915021754904        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 230: 0.09874226011060797        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 240: 0.09661610675660723        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 250: 0.09459578329674258        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 260: 0.09268972700052056        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 270: 0.09087815433431119        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 280: 0.0891395260038106        train accuracy: 97.39583333333334
--------------------------------------------------------------------------------
Cost iteration 290: 0.08747122826408682        train accuracy: 97.65625
--------------------------------------------------------------------------------
Cost iteration 300: 0.08586673589237845        train accuracy: 97.65625
--------------------------------------------------------------------------------
Cost iteration 310: 0.08432645268766144        train accuracy: 97.65625
--------------------------------------------------------------------------------
Cost iteration 320: 0.08283356065474806        train accuracy: 97.65625
--------------------------------------------------------------------------------
Cost iteration 330: 0.08138847487662934        train accuracy: 97.65625
--------------------------------------------------------------------------------
Cost iteration 340: 0.07999071507689584        train accuracy: 97.91666666666667
--------------------------------------------------------------------------------
Cost iteration 350: 0.07863697457549448        train accuracy: 97.91666666666667
--------------------------------------------------------------------------------
Cost iteration 360: 0.07732360662446022        train accuracy: 98.17708333333334
--------------------------------------------------------------------------------
Cost iteration 370: 0.07603758805976474        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 380: 0.0747807336071315        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 390: 0.07355767530810059        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 400: 0.07236963754437824        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 410: 0.07121117960640994        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 420: 0.07007942394723778        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 430: 0.0689649391949893        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 440: 0.0678791867478043        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 450: 0.06682067518475378        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 460: 0.06578566645362258        train accuracy: 98.4375
--------------------------------------------------------------------------------
Cost iteration 470: 0.06478313530150383        train accuracy: 98.69791666666667
--------------------------------------------------------------------------------
Cost iteration 480: 0.06377764299028812        train accuracy: 98.95833333333334
--------------------------------------------------------------------------------
Cost iteration 490: 0.06279034668920719        train accuracy: 98.95833333333334
--------------------------------------------------------------------------------
Cost iteration 500: 0.06183179269223119        train accuracy: 98.95833333333334
```

```
Cost iteration 510: 0.06089225259647281        train accuracy: 98.95833333333334
Cost iteration 520: 0.059996268600793365        train accuracy: 98.95833333333334
Cost iteration 530: 0.059121617263022654        train accuracy: 98.95833333333334
Cost iteration 540: 0.05826560496968792        train accuracy: 98.95833333333334
Cost iteration 550: 0.057419187211640785        train accuracy: 98.95833333333334
Cost iteration 560: 0.0566027809693222        train accuracy: 98.95833333333334
Cost iteration 570: 0.055796499580066924        train accuracy: 98.95833333333334
Cost iteration 580: 0.05500660290234316        train accuracy: 98.95833333333334
Cost iteration 590: 0.054230421981639396        train accuracy: 98.95833333333334
Cost iteration 600: 0.05346302520868708        train accuracy: 98.95833333333334
Cost iteration 610: 0.05270830042772252        train accuracy: 98.95833333333334
Cost iteration 620: 0.051968843213395705        train accuracy: 98.95833333333334
Cost iteration 630: 0.05123337499886122        train accuracy: 98.95833333333334
Cost iteration 640: 0.05051828572763426        train accuracy: 98.95833333333334
Cost iteration 650: 0.049810139319780046        train accuracy: 98.95833333333334
Cost iteration 660: 0.0491057433151746        train accuracy: 98.95833333333334
Cost iteration 670: 0.04841609559437119        train accuracy: 98.95833333333334
Cost iteration 680: 0.04773287889830877        train accuracy: 98.95833333333334
Cost iteration 690: 0.0470658327062426        train accuracy: 98.95833333333334
Cost iteration 700: 0.04640217797800278        train accuracy: 98.95833333333334
Cost iteration 710: 0.04574803116530602        train accuracy: 98.95833333333334
Cost iteration 720: 0.04510046702185773        train accuracy: 98.95833333333334
Cost iteration 730: 0.04446781129283239        train accuracy: 98.95833333333334
Cost iteration 740: 0.04383987371399546        train accuracy: 98.95833333333334
Cost iteration 750: 0.04322471977145723        train accuracy: 98.95833333333334
Cost iteration 760: 0.04262057372317615        train accuracy: 98.95833333333334
Cost iteration 770: 0.042024377472412645        train accuracy: 98.95833333333334
Cost iteration 780: 0.04143794193273898        train accuracy: 98.95833333333334
Cost iteration 790: 0.04086854284636233        train accuracy: 98.95833333333334
Cost iteration 800: 0.040289044830571524        train accuracy: 98.95833333333334
Cost iteration 810: 0.03971439260499739        train accuracy: 98.95833333333334
Cost iteration 820: 0.0391426809683319        train accuracy: 98.95833333333334
Cost iteration 830: 0.03858687135420953        train accuracy: 98.95833333333334
Cost iteration 840: 0.038043511030818065        train accuracy: 99.21875
Cost iteration 850: 0.03749914747012596        train accuracy: 99.21875
Cost iteration 860: 0.03695999388419285        train accuracy: 99.21875
Cost iteration 870: 0.03643593667787913        train accuracy: 99.21875
Cost iteration 880: 0.03591546670010809        train accuracy: 99.21875
Cost iteration 890: 0.03540482122310136        train accuracy: 99.21875
Cost iteration 900: 0.034902906264104416        train accuracy: 99.21875
```

```
Cost iteration 910: 0.03440940743634384        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 920: 0.03393826667829392        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 930: 0.03347725983001515        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 940: 0.0330219150035909        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 950: 0.032581597296874557        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 960: 0.03214594403219632        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 970: 0.03172867418700435        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 980: 0.03131713525388741        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 990: 0.03091016749102557        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 1000: 0.03052086795951037        train accuracy:99.21875
```

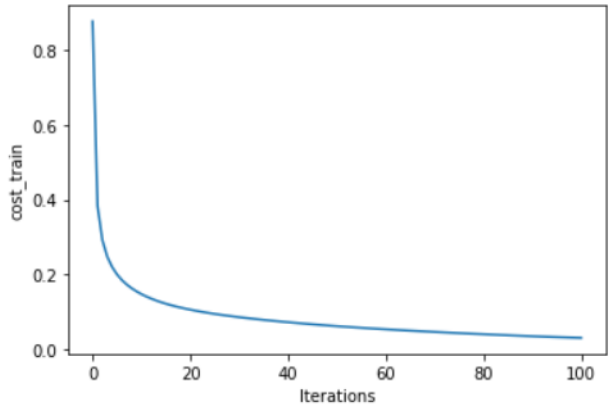
-
- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

```
Cost iteration 0: 0.7289920431217777        test accuracy: 59.375
-------------------------------------------------------------------------------
Cost iteration 10: 0.38854185350708936        test accuracy: 81.25
-------------------------------------------------------------------------------
Cost iteration 20: 0.3089739220243424        test accuracy: 86.45833333333334
-------------------------------------------------------------------------------
Cost iteration 30: 0.26867540657843886        test accuracy: 87.5
-------------------------------------------------------------------------------
Cost iteration 40: 0.24465199308123264        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 50: 0.22892126227796822        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 60: 0.2180764817898905        test accuracy: 91.66666666666667
-------------------------------------------------------------------------------
Cost iteration 70: 0.21034718928265675        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost iteration 80: 0.20473468646533613        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost iteration 90: 0.20045144669081175        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost iteration 100: 0.1971203657337092        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost iteration 110: 0.19448876202902216        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 120: 0.19237322327837164        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 130: 0.19052326536543257        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 140: 0.18890969404939273        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 150: 0.1875528545872708        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 160: 0.18634899902781876        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 170: 0.1852516879360464        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 180: 0.18430323920966646        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 190: 0.18351786788346028        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost iteration 200: 0.1828055568021886        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost iteration 210: 0.18210193211254727        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost iteration 220: 0.18137359170967        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 230: 0.1806692465498573        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 240: 0.1800422156855406        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 250: 0.1794410669248983        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 260: 0.17888096269278078        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 270: 0.17833495571069247        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost iteration 280: 0.17776906911554394        test accuracy: 90.625
-------------------------------------------------------------------------------
```

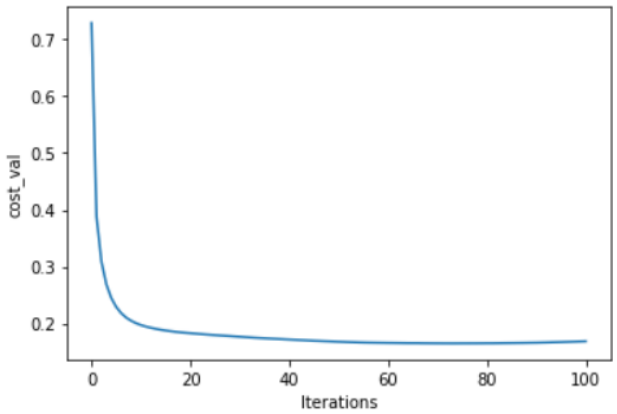
```
Cost iteration 290: 0.1771292371713801        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 300: 0.17656564606346165        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 310: 0.17596061287333545        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 320: 0.175409491227443        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 330: 0.17484459789159482        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 340: 0.17438206846608065        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 350: 0.17389857434251743        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 360: 0.173422989130028        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 370: 0.17298742233591793        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 380: 0.17257787896903956        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 390: 0.17212884049527194        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 400: 0.1716668026508526        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 410: 0.17123598876191748        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 420: 0.1708515565114891        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 430: 0.17045354592999232        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 440: 0.16998751053215347        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 450: 0.16952014850018537        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 460: 0.1691996135824464        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 470: 0.16881913075275992        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 480: 0.16851016267609212        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 490: 0.16814304129401636        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 500: 0.16779653477685114        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 510: 0.16751926409324258        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 520: 0.1672076363205333        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 530: 0.1669526042635503        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 540: 0.16666250435854485        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 550: 0.1664377107953437        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 560: 0.16625587050416063        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 570: 0.1661543527174047        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 580: 0.1660197724727625        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 590: 0.16590561874467186        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 600: 0.16578779664285237        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 610: 0.165711810549494        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 620: 0.1656066974084091        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 630: 0.16550429973992453        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 640: 0.16540573243715936        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 650: 0.1653792214678853        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 660: 0.16537449261769935        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 670: 0.16521119112372618        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost iteration 680: 0.16514875694790226        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost iteration 690: 0.16507396872600752        test accuracy: 90.625
```

```
Cost iteration 700: 0.16504010757563803        test accuracy: 90.625
Cost iteration 710: 0.1649772962288676        test accuracy: 90.625
Cost iteration 720: 0.16496199381967902        test accuracy: 90.625
Cost iteration 730: 0.16492374862014927        test accuracy: 90.625
Cost iteration 740: 0.1649522897256598        test accuracy: 90.625
Cost iteration 750: 0.16501273752081294        test accuracy: 90.625
Cost iteration 760: 0.16500640973494402        test accuracy: 90.625
Cost iteration 770: 0.16505267654625605        test accuracy: 90.625
Cost iteration 780: 0.1650476967572723        test accuracy: 90.625
Cost iteration 790: 0.16510955780181433        test accuracy: 90.625
Cost iteration 800: 0.1651814465956347        test accuracy: 90.625
Cost iteration 810: 0.16518533450671763        test accuracy: 90.625
Cost iteration 820: 0.1652831164075154        test accuracy: 90.625
Cost iteration 830: 0.1653981757014364        test accuracy: 90.625
Cost iteration 840: 0.16547785352240255        test accuracy: 90.625
Cost iteration 850: 0.16557864780585405        test accuracy: 90.625
Cost iteration 860: 0.1656712284775479        test accuracy: 91.66666666666667
Cost iteration 870: 0.16576621056814997        test accuracy: 91.66666666666667
Cost iteration 880: 0.1659049921484106        test accuracy: 91.66666666666667
Cost iteration 890: 0.1660412465865224        test accuracy: 91.66666666666667
Cost iteration 900: 0.16614557577672093        test accuracy: 91.66666666666667
Cost iteration 910: 0.1663457625127157        test accuracy: 92.70833333333334
Cost iteration 920: 0.16655095289771776        test accuracy: 92.70833333333334
Cost iteration 930: 0.16678887098677975        test accuracy: 92.70833333333334
Cost iteration 940: 0.16703134458402097        test accuracy: 92.70833333333334
Cost iteration 950: 0.16725420641906524        test accuracy: 92.70833333333334
Cost iteration 960: 0.16750587040403178        test accuracy: 92.70833333333334
Cost iteration 970: 0.16776724231741907        test accuracy: 92.70833333333334
Cost iteration 980: 0.16803887232477543        test accuracy: 92.70833333333334
Cost iteration 990: 0.16833463469595272        test accuracy: 92.70833333333334
Cost iteration 1000: 0.1686154375065012        test accuracy: 92.70833333333334
```

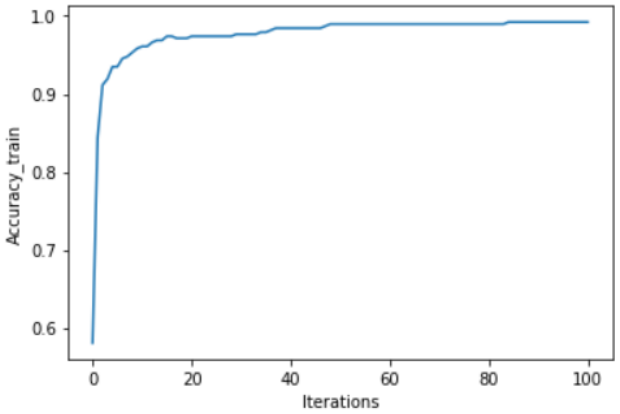
- **نمودار تغییر Loss مجموعه آموزش**



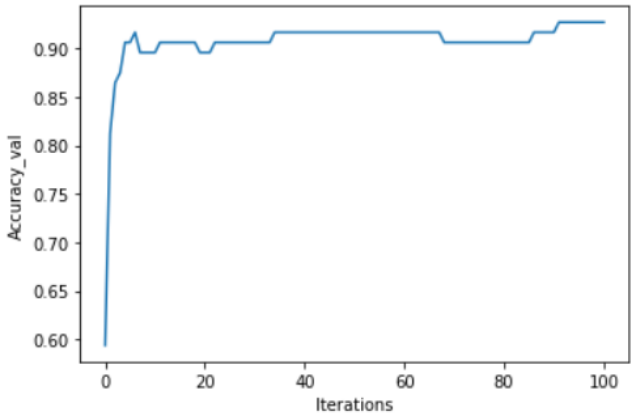
- نمودار تغییر Loss مجموعه ارزیابی



- نمودار تغییر Accuracy مجموعه آموزش



- نمودار تغییر Accuracy مجموعه ارزیابی



- تعداد لایه=5:
  - شکل خروجی کد (Loss و Accuracy) مجموعه آموزش

```
Cost iteration 0: 1.2091980443937116        train accuracy: 50.78125
-------------------------------------------------------------------------------
Cost iteration 10: 0.5098302889343702        train accuracy: 75.26041666666666
```

```
Cost iteration 20: 0.40503131815378823        train accuracy: 80.98958333333334
Cost iteration 30: 0.30612962610111993        train accuracy: 89.0625
Cost iteration 40: 0.23299315267663656        train accuracy: 92.96875
Cost iteration 50: 0.18651355096148892        train accuracy: 94.79166666666667
Cost iteration 60: 0.15713695657407725        train accuracy: 95.3125
Cost iteration 70: 0.13613881287545754        train accuracy: 95.83333333333334
Cost iteration 80: 0.12044837096513608        train accuracy: 96.35416666666667
Cost iteration 90: 0.10792269665176897        train accuracy: 97.13541666666667
Cost iteration 100: 0.09767621190944804        train accuracy: 97.13541666666667
Cost iteration 110: 0.08915934289344131        train accuracy: 97.65625
Cost iteration 120: 0.0817837786248068        train accuracy: 97.91666666666667
Cost iteration 130: 0.07533661716276838        train accuracy: 97.91666666666667
Cost iteration 140: 0.06945719758875132        train accuracy: 98.17708333333334
Cost iteration 150: 0.06443883557226288        train accuracy: 98.4375
Cost iteration 160: 0.060168470205243886        train accuracy: 98.69791666666667
Cost iteration 170: 0.05652596706843725        train accuracy: 98.69791666666667
Cost iteration 180: 0.05280819279928934        train accuracy: 98.69791666666667
Cost iteration 190: 0.04983930368738061        train accuracy: 98.69791666666667
Cost iteration 200: 0.04732470820013153        train accuracy: 98.69791666666667
Cost iteration 210: 0.045053327034727295        train accuracy: 98.69791666666667
Cost iteration 220: 0.0429917989954704        train accuracy: 98.69791666666667
Cost iteration 230: 0.04114076277189674        train accuracy: 98.95833333333334
Cost iteration 240: 0.03948882538894458        train accuracy: 98.95833333333334
Cost iteration 250: 0.03791419675290239        train accuracy: 98.95833333333334
Cost iteration 260: 0.036324887282605814        train accuracy: 98.95833333333334
Cost iteration 270: 0.03483450091846604        train accuracy: 98.95833333333334
Cost iteration 280: 0.03339709394463558        train accuracy: 98.95833333333334
Cost iteration 290: 0.032018856558760675        train accuracy: 98.95833333333334
Cost iteration 300: 0.03070396625437437        train accuracy: 98.95833333333334
Cost iteration 310: 0.02947614020119524        train accuracy: 98.95833333333334
Cost iteration 320: 0.028273792429287584        train accuracy: 98.95833333333334
Cost iteration 330: 0.027118600947156894        train accuracy: 98.95833333333334
Cost iteration 340: 0.026012176284507586        train accuracy: 98.95833333333334
Cost iteration 350: 0.025007327078593506        train accuracy: 98.95833333333334
Cost iteration 360: 0.024018899681097716        train accuracy: 98.95833333333334
Cost iteration 370: 0.02312465508542117        train accuracy: 98.95833333333334
Cost iteration 380: 0.022287582026478896        train accuracy: 98.95833333333334
Cost iteration 390: 0.021472395384554456        train accuracy: 98.95833333333334
Cost iteration 400: 0.020716073459368548        train accuracy: 99.21875
Cost iteration 410: 0.020016579832445088        train accuracy: 99.21875
```

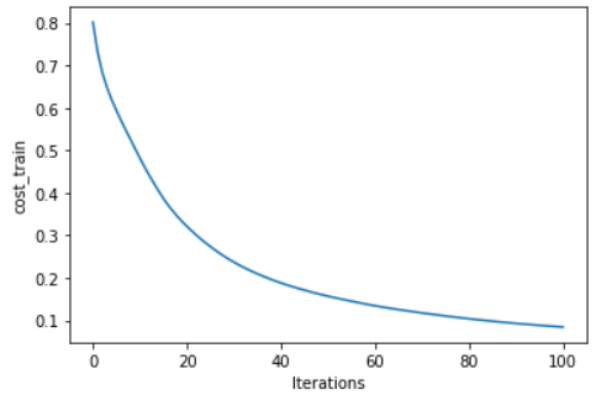
```
Cost iteration 420: 0.019333076526771742        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 430: 0.018688746578895146        train accuracy: 99.21875
-------------------------------------------------------------------------------
Cost iteration 440: 0.01808082482349147        train accuracy: 99.47916666666667
-------------------------------------------------------------------------------
Cost iteration 450: 0.01749741592333633        train accuracy: 99.47916666666667
-------------------------------------------------------------------------------
Cost iteration 460: 0.016939581645894077        train accuracy: 99.47916666666667
-------------------------------------------------------------------------------
Cost iteration 470: 0.016429382783459096        train accuracy: 99.47916666666667
-------------------------------------------------------------------------------
Cost iteration 480: 0.0158967451072394        train accuracy: 99.47916666666667
-------------------------------------------------------------------------------
Cost iteration 490: 0.015381129338230467        train accuracy: 99.73958333333334
-------------------------------------------------------------------------------
Cost iteration 500: 0.014899165146164423        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 510: 0.014430500747094722        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 520: 0.013971961750994863        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 530: 0.013552450239357758        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 540: 0.013143971054398804        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 550: 0.012736560728359405        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 560: 0.012351723413132652        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 570: 0.011991967679716792        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 580: 0.011619833994766522        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 590: 0.011278737412127912        train accuracy: 100.0
-------------------------------------------------------------------------------
Cost iteration 600: 0.010946554952055959        train accuracy: 100.0
-------------------------------------------------------------------------------
```

- **شکل خروجی کد (Loss و Accuracy) مجموعه ارزیابی**

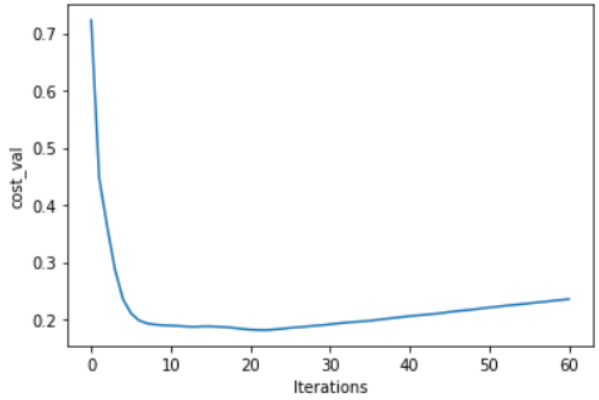
```
Cost after iteration 0: 0.7229621892130254        test accuracy: 59.375
-------------------------------------------------------------------------------
Cost after iteration 10: 0.44731879083621845        test accuracy: 81.25
-------------------------------------------------------------------------------
Cost after iteration 20: 0.36266208233576        test accuracy: 87.5
-------------------------------------------------------------------------------
Cost after iteration 30: 0.2864192346827889        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost after iteration 40: 0.23529164649987178        test accuracy: 91.66666666666667
-------------------------------------------------------------------------------
Cost after iteration 50: 0.2107550580404206        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost after iteration 60: 0.19841053788492935        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost after iteration 70: 0.1932173637950223        test accuracy: 88.54166666666667
-------------------------------------------------------------------------------
Cost after iteration 80: 0.19105662180560795        test accuracy: 88.54166666666667
-------------------------------------------------------------------------------
Cost after iteration 90: 0.18998330113340395        test accuracy: 88.54166666666667
-------------------------------------------------------------------------------
Cost after iteration 100: 0.18935530943357562        test accuracy: 88.54166666666667
-------------------------------------------------------------------------------
Cost after iteration 110: 0.18876625205862133        test accuracy: 88.54166666666667
-------------------------------------------------------------------------------
Cost after iteration 120: 0.18766089744638395        test accuracy: 88.54166666666667
-------------------------------------------------------------------------------
Cost after iteration 130: 0.18722605645874085        test accuracy: 88.54166666666667
-------------------------------------------------------------------------------
Cost after iteration 140: 0.18796293472075015        test accuracy: 89.58333333333334
-------------------------------------------------------------------------------
Cost after iteration 150: 0.18800634258649299        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost after iteration 160: 0.18729772605565004        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost after iteration 170: 0.18649960337984645        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost after iteration 180: 0.18516633184038958        test accuracy: 90.625
-------------------------------------------------------------------------------
Cost after iteration 190: 0.18350140594784065        test accuracy: 90.625
-------------------------------------------------------------------------------
```

```
Cost after iteration 200: 0.1822470351004737        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost after iteration 210: 0.18161277485874477        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost after iteration 220: 0.1814277497563057        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost after iteration 230: 0.1826229406263722        test accuracy: 90.625
--------------------------------------------------------------------------------
Cost after iteration 240: 0.18377351719150306        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 250: 0.18534985276182894        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 260: 0.18642815803141094        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost after iteration 270: 0.18763980941438752        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost after iteration 280: 0.189018289384827        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost after iteration 290: 0.19004110671909383        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost after iteration 300: 0.1915848017289298        test accuracy: 92.70833333333334
--------------------------------------------------------------------------------
Cost after iteration 310: 0.19309835879426107        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 320: 0.1945733127424389        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 330: 0.19558226681503948        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 340: 0.19670578375071116        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 350: 0.19775815284917098        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 360: 0.19947334881489853        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 370: 0.20117746342744425        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 380: 0.202688226562945        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 390: 0.20428923365772933        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 400: 0.20595943315446769        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 410: 0.20711460419702665        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 420: 0.20828764329320992        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 430: 0.2097312774946205        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 440: 0.2112637691454547        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 450: 0.2131682551079788        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 460: 0.2147579034698362        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 470: 0.21613054240978813        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 480: 0.21738615638851677        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 490: 0.21930929274159727        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 500: 0.22090230610558492        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 510: 0.2224352314572131        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 520: 0.22401752993892032        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 530: 0.22537410433891797        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 540: 0.22671992190529366        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 550: 0.2280911137818269        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 560: 0.2298694525629031        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 570: 0.2309811733366085        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 580: 0.2327622008167068        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 590: 0.2341684901067166        test accuracy: 91.66666666666667
--------------------------------------------------------------------------------
Cost after iteration 600: 0.23555962653488116        test accuracy: 91.66666666666667
```

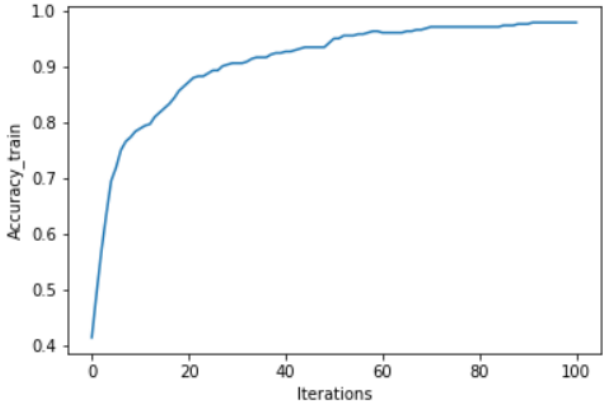
- **نمودار تغییر Loss مجموعه آموزش**



- **نمودار تغییر Loss مجموعه ارزیابی**



- **نمودار تغییر Accuracy مجموعه آموزش**



- **نمودار تغییر Accuracy مجموعه ارزیابی**