

# 机器学习大作业

——关于《AlphaZero-Gomoku》代码的运行以及训练

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## 一、设计思路

由于对五子棋比较感兴趣，所以与宿舍同好桂壮飞同学，一同选择了这篇关于五子棋对战的“AlphaZero Gomoku”代码进行研究。

这是 AlphaZero 算法的一种实现，用于通过纯自玩训练来玩简单的棋盘游戏 Gomoku（也称为 Gobang 或连续五人）。Gomoku 游戏比 Go 或国际象棋简单得多，因此我们可以专注于 AlphaZero 的训练方案，并在几个小时内单台 PC 上获得相当不错的 AI 模型。

我们在 Github 上下载了代码压缩包，得到如图 1 的文件。



```
!! Aegeads Powershell Prompt (pytho)
d1=0.02662,lr_multiplier=1,800,loss=3.9460520310466895,entropy=3.3880081176767812,explained_var_old=0.367,explained_var_new=0.432
batch 1:23, episode_len=15
d1=0.02673,lr_multiplier=1,500,loss=3.87317241698701,entropy=3.358644742159982,explained_var_old=0.408,explained_var_new=0.466
batch 1:24, episode_len=25
d1=0.02678,lr_multiplier=1,500,loss=3.849741220474243,entropy=3.337215157169,explained_var_old=0.421,explained_var_new=0.499
batch 1:25, episode_len=25
d1=0.02680,lr_multiplier=1,500,loss=3.785900115966797,entropy=3.237768849789795,explained_var_old=0.415,explained_var_new=0.497
batch 1:26, episode_len=9
d1=0.02682,lr_multiplier=1,500,loss=3.680867438479736,entropy=3.223551117648264,explained_var_old=0.467,explained_var_new=0.561
batch 1:27, episode_len=10
d1=0.02682,lr_multiplier=1,000,loss=3.756702134677124,entropy=3.29899101257224,explained_var_old=0.420,explained_var_new=0.519
batch 1:28, episode_len=12
d1=0.02679,lr_multiplier=1,000,loss=3.717761933480203,entropy=3.213812351263066,explained_var_old=0.448,explained_var_new=0.522
batch 1:29, episode_len=16
d1=0.02410,lr_multiplier=1,000,loss=3.792444763183594,entropy=3.2603733959198,explained_var_old=0.371,explained_var_new=0.483
batch 1:30, episode_len=10
d1=0.02793,lr_multiplier=1,000,loss=3.7294399738311768,entropy=3.243303757873535,explained_var_old=0.432,explained_var_new=0.524
batch 1:31, episode_len=12
d1=0.02645,lr_multiplier=1,000,loss=3.68224232223633,entropy=3.211961269378662,explained_var_old=0.441,explained_var_new=0.521
batch 1:32, episode_len=18
d1=0.02615,lr_multiplier=1,000,loss=3.7897262672329,entropy=3.233882850646973,explained_var_old=0.361,explained_var_new=0.458
batch 1:33, episode_len=18
d1=0.02699,lr_multiplier=1,000,loss=3.7894588030709684,entropy=3.146358499902344,explained_var_old=0.317,explained_var_new=0.394
batch 1:34, episode_len=11
d1=0.02665,lr_multiplier=1,000,loss=3.784521877234407,entropy=3.20944166134717,explained_var_old=0.312,explained_var_new=0.452
batch 1:35, episode_len=10
d1=0.02695,lr_multiplier=1,000,loss=3.740720748901367,entropy=3.19706731994629,explained_var_old=0.321,explained_var_new=0.450
batch 1:36, episode_len=12
d1=0.02794,lr_multiplier=1,000,loss=3.692485103607178,entropy=3.15255470442505,explained_var_old=0.319,explained_var_new=0.480
batch 1:37, episode_len=9
d1=0.02661,lr_multiplier=1,000,loss=3.669452465057372,entropy=3.13657853085327,explained_var_old=0.376,explained_var_new=0.480
batch 1:38, episode_len=12
d1=0.02654,lr_multiplier=1,000,loss=3.67151944619873,entropy=3.097052632882764,explained_var_old=0.353,explained_var_new=0.486
batch 1:39, episode_len=20
d1=0.02697,lr_multiplier=1,000,loss=3.58337889924316,entropy=3.0787281467285,explained_var_old=0.392,explained_var_new=0.489
batch 1:40, episode_len=19
d1=0.02636,lr_multiplier=0.667,loss=3.515893965463257,entropy=3.0503225205238,explained_var_old=0.437,explained_var_new=0.554
batch 1:41, episode_len=12
d1=0.02654,lr_multiplier=0.667,loss=3.61029203063965,entropy=3.09262084609375,explained_var_old=0.431,explained_var_new=0.501
batch 1:42, episode_len=9
d1=0.02680,lr_multiplier=0.667,loss=3.69443726396118,entropy=3.0928786970312,explained_var_old=0.331,explained_var_new=0.409
batch 1:43, episode_len=11
d1=0.02610,lr_multiplier=0.667,loss=3.68963412388254,entropy=3.119739249652124,explained_var_old=0.367,explained_var_new=0.450
batch 1:44, episode_len=13
d1=0.02697,lr_multiplier=0.667,loss=3.5547522048960195,entropy=3.105690024414052,explained_var_old=0.410,explained_var_new=0.483
batch 1:45, episode_len=12
d1=0.02411,lr_multiplier=0.667,loss=3.5573246479034424,entropy=3.002361530495643,explained_var_old=0.417,explained_var_new=0.483
batch 1:46, episode_len=11
d1=0.02794,lr_multiplier=0.667,loss=3.58462324295044,entropy=3.049157381677393,explained_var_old=0.398,explained_var_new=0.472
batch 1:47, episode_len=12
d1=0.02685,lr_multiplier=0.667,loss=3.5770570190429688,entropy=3.0222142720713,explained_var_old=0.367,explained_var_new=0.447
batch 1:48, episode_len=12
d1=0.02621,lr_multiplier=0.667,loss=3.5727496810412598,entropy=3.049351930618286,explained_var_old=0.416,explained_var_new=0.497
batch 1:49, episode_len=12
d1=0.02693,lr_multiplier=0.667,loss=3.6241588999328965,entropy=3.10674942779541,explained_var_old=0.357,explained_var_new=0.441
batch 1:50, episode_len=14
d1=0.02697,lr_multiplier=0.667,loss=3.572314739227295,entropy=3.001903772354126,explained_var_old=0.348,explained_var_new=0.433
current self-play batch: 50
num.playouts:1000, win: 2, loss: 8, tie:0
New best policy!!!!!!
batch 1:51, episode_len=18
d1=0.02622,lr_multiplier=0.667,loss=3.68968076324463,entropy=3.03965232296509,explained_var_old=0.285,explained_var_new=0.362
batch 1:52, episode_len=10
d1=0.02625,lr_multiplier=0.667,loss=3.59839817642212,entropy=3.027782440185547,explained_var_old=0.313,explained_var_new=0.406
batch 1:53, episode_len=8
d1=0.02697,lr_multiplier=0.444,loss=3.6094068772466094,entropy=3.045478297637936,explained_var_old=0.294,explained_var_new=0.366
batch 1:54, episode_len=9
d1=0.02682,lr_multiplier=0.444,loss=3.601804732276367,entropy=2.9957542009033,explained_var_old=0.278,explained_var_new=0.434
batch 1:55, episode_len=7
d1=0.01821,lr_multiplier=0.444,loss=3.634590868088867,entropy=3.01196289625,explained_var_old=0.313,explained_var_new=0.375
batch 1:56, episode_len=19
d1=0.01489,lr_multiplier=0.444,loss=3.6035373210906882,entropy=3.003572948282416,explained_var_old=0.321,explained_var_new=0.384
batch 1:57, episode_len=10
d1=0.01892,lr_multiplier=0.444,loss=3.61910140609741,entropy=3.005660682273154,explained_var_old=0.329,explained_var_new=0.396
batch 1:58, episode_len=14
d1=0.01892,lr_multiplier=0.444,loss=3.545046329489291,entropy=2.9839775562288377,explained_var_old=0.362,explained_var_new=0.407
batch 1:59, episode_len=11
d1=0.01877,lr_multiplier=0.444,loss=3.626770782470703,entropy=2.9814634323120117,explained_var_old=0.299,explained_var_new=0.352
batch 1:60, episode_len=10
d1=0.01854,lr_multiplier=0.444,loss=3.547327995300293,entropy=2.9610040187835993,explained_var_old=0.374,explained_var_new=0.422
batch 1:61, episode_len=7
d1=0.01379,lr_multiplier=0.444,loss=3.49633837462158,entropy=2.924835061264038,explained_var_old=0.365,explained_var_new=0.438
batch 1:62, episode_len=10
d1=0.01828,lr_multiplier=0.444,loss=3.59888672288743,entropy=2.9785900115966797,explained_var_old=0.321,explained_var_new=0.392
batch 1:63, episode_len=11
d1=0.01855,lr_multiplier=0.444,loss=3.5989649295806885,entropy=2.902590963227354,explained_var_old=0.368,explained_var_new=0.410
batch 1:64, episode_len=15
d1=0.01891,lr_multiplier=0.444,loss=3.5301949977874756,entropy=2.93202756874634,explained_var_old=0.312,explained_var_new=0.375
batch 1:65, episode_len=10
d1=0.01784,lr_multiplier=0.444,loss=3.5902127783478556,entropy=2.959921360015889,explained_var_old=0.282,explained_var_new=0.349
batch 1:66, episode_len=15
d1=0.01121,lr_multiplier=0.444,loss=3.5306053161621094,entropy=2.945111026763916,explained_var_old=0.349,explained_var_new=0.416
batch 1:67, episode_len=12
d1=0.01802,lr_multiplier=0.444,loss=3.540228538632036,entropy=2.971347320007324,explained_var_old=0.329,explained_var_new=0.401
batch 1:68, episode_len=9
d1=0.01852,lr_multiplier=0.444,loss=3.5621285438537598,entropy=2.976824297180176,explained_var_old=0.296,explained_var_new=0.364
batch 1:69, episode_len=9
d1=0.01820,lr_multiplier=0.444,loss=3.5790107290218623,entropy=2.953091648115234,explained_var_old=0.307,explained_var_new=0.375
batch 1:70, episode_len=14
d1=0.01892,lr_multiplier=0.444,loss=3.5802948474834033,entropy=2.936482309968872,explained_var_old=0.310,explained_var_new=0.389
batch 1:71, episode_len=12
d1=0.01788,lr_multiplier=0.444,loss=3.58184820251465,entropy=2.9491805634918213,explained_var_old=0.309,explained_var_new=0.368
batch 1:72, episode_len=10
d1=0.01420,lr_multiplier=0.444,loss=3.52178529246826,entropy=2.9313385496602783,explained_var_old=0.323,explained_var_new=0.391
batch 1:73, episode_len=12
d1=0.01823,lr_multiplier=0.444,loss=3.5289015789958496,entropy=2.9510083198547362,explained_var_old=0.358,explained_var_new=0.416
batch 1:74, episode_len=13
d1=0.02066,lr_multiplier=0.444,loss=3.53053859399961,entropy=2.915510122680664,explained_var_old=0.298,explained_var_new=0.366
batch 1:75, episode_len=8
d1=0.01898,lr_multiplier=0.444,loss=3.4971108436584472,entropy=2.9072727487193604,explained_var_old=0.356,explained_var_new=0.409
batch 1:76, episode_len=13
d1=0.02481,lr_multiplier=0.444,loss=3.5209450721740722,entropy=2.8533995151519775,explained_var_old=0.269,explained_var_new=0.329
batch 1:77, episode_len=15
d1=0.01485,lr_multiplier=0.444,loss=3.510392189025879,entropy=2.903468132019043,explained_var_old=0.344,explained_var_new=0.408
batch 1:78, episode_len=11
d1=0.01367,lr_multiplier=0.444,loss=3.513014316558383,entropy=2.928459465999048,explained_var_old=0.302,explained_var_new=0.394
batch 1:79, episode_len=7
d1=0.01480,lr_multiplier=0.444,loss=3.531136059191895,entropy=2.931120781707764,explained_var_old=0.339,explained_var_new=0.396
batch 1:80, episode_len=9
d1=0.02624,lr_multiplier=0.444,loss=3.526563059638795,entropy=2.921102048665527,explained_var_old=0.330,explained_var_new=0.400
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!! Aegeads Powershell Prompt (pytho)
d1=0.02783,lr_multiplier=0.667,loss=3.624188899938965,entropy=3.106874942779541,explained_var_old=0.357,explained_var_new=0.441
batch 1:59, episode_len=14
d1=0.02697,lr_multiplier=0.667,loss=3.572314739227295,entropy=3.001903772354126,explained_var_old=0.348,explained_var_new=0.433
current self-play batch: 50
num.playouts:1000, win: 2, loss: 8, tie:0
New best policy!!!!!!
batch 1:51, episode_len=18
d1=0.02622,lr_multiplier=0.667,loss=3.68968076324463,entropy=3.03965232296509,explained_var_old=0.285,explained_var_new=0.362
batch 1:52, episode_len=10
d1=0.02625,lr_multiplier=0.667,loss=3.59839817642212,entropy=3.027782440185547,explained_var_old=0.313,explained_var_new=0.406
batch 1:53, episode_len=8
d1=0.02697,lr_multiplier=0.444,loss=3.6094068772466094,entropy=3.045478297637936,explained_var_old=0.294,explained_var_new=0.366
batch 1:54, episode_len=9
d1=0.02682,lr_multiplier=0.444,loss=3.601804732276367,entropy=2.9957542009033,explained_var_old=0.278,explained_var_new=0.434
batch 1:55, episode_len=7
d1=0.01821,lr_multiplier=0.444,loss=3.634590868088867,entropy=3.01196289625,explained_var_old=0.313,explained_var_new=0.375
batch 1:56, episode_len=19
d1=0.01489,lr_multiplier=0.444,loss=3.6035373210906882,entropy=3.003572948282416,explained_var_old=0.321,explained_var_new=0.384
batch 1:57, episode_len=10
d1=0.01892,lr_multiplier=0.444,loss=3.61910140609741,entropy=3.005660682273154,explained_var_old=0.329,explained_var_new=0.396
batch 1:58, episode_len=14
d1=0.01892,lr_multiplier=0.444,loss=3.545046329489291,entropy=2.9839775562288377,explained_var_old=0.362,explained_var_new=0.407
batch 1:59, episode_len=11
d1=0.01877,lr_multiplier=0.444,loss=3.626770782470703,entropy=2.9814634323120117,explained_var_old=0.299,explained_var_new=0.352
batch 1:60, episode_len=10
d1=0.01854,lr_multiplier=0.444,loss=3.547327995300293,entropy=2.9610040187835993,explained_var_old=0.374,explained_var_new=0.422
batch 1:61, episode_len=7
d1=0.01379,lr_multiplier=0.444,loss=3.49633837462158,entropy=2.924835061264038,explained_var_old=0.365,explained_var_new=0.438
batch 1:62, episode_len=10
d1=0.01828,lr_multiplier=0.444,loss=3.59888672288743,entropy=2.9785900115966797,explained_var_old=0.321,explained_var_new=0.392
batch 1:63, episode_len=11
d1=0.01855,lr_multiplier=0.444,loss=3.5989649295806885,entropy=2.902590963227354,explained_var_old=0.368,explained_var_new=0.410
batch 1:64, episode_len=15
d1=0.01891,lr_multiplier=0.444,loss=3.5301949977874756,entropy=2.93202756874634,explained_var_old=0.312,explained_var_new=0.375
batch 1:65, episode_len=10
d1=0.01784,lr_multiplier=0.444,loss=3.5902127783478556,entropy=2.959921360015889,explained_var_old=0.282,explained_var_new=0.349
batch 1:66, episode_len=15
d1=0.01121,lr_multiplier=0.444,loss=3.5306053161621094,entropy=2.945111026763916,explained_var_old=0.349,explained_var_new=0.416
batch 1:67, episode_len=12
d1=0.01802,lr_multiplier=0.444,loss=3.540228538632036,entropy=2.971347320007324,explained_var_old=0.329,explained_var_new=0.401
batch 1:68, episode_len=9
d1=0.01852,lr_multiplier=0.444,loss=3.5621285438537598,entropy=2.976824297180176,explained_var_old=0.296,explained_var_new=0.364
batch 1:69, episode_len=9
d1=0.01820,lr_multiplier=0.444,loss=3.5790107290218623,entropy=2.953091648115234,explained_var_old=0.307,explained_var_new=0.375
batch 1:70, episode_len=14
d1=0.01892,lr_multiplier=0.444,loss=3.5802948474834033,entropy=2.936482309968872,explained_var_old=0.310,explained_var_new=0.389
batch 1:71, episode_len=12
d1=0.01788,lr_multiplier=0.444,loss=3.58184820251465,entropy=2.9491805634918213,explained_var_old=0.309,explained_var_new=0.368
batch 1:72, episode_len=10
d1=0.01420,lr_multiplier=0.444,loss=3.52178529246826,entropy=2.9313385496602783,explained_var_old=0.323,explained_var_new=0.391
batch 1:73, episode_len=12
d1=0.01823,lr_multiplier=0.444,loss=3.5289015789958496,entropy=2.9510083198547362,explained_var_old=0.358,explained_var_new=0.416
batch 1:74, episode_len=13
d1=0.02066,lr_multiplier=0.444,loss=3.53053859399961,entropy=2.915510122680664,explained_var_old=0.298,explained_var_new=0.366
batch 1:75, episode_len=8
d1=0.01898,lr_multiplier=0.444,loss=3.4971108436584472,entropy=2.9072727487193604,explained_var_old=0.356,explained_var_new=0.409
batch 1:76, episode_len=13
d1=0.02481,lr_multiplier=0.444,loss=3.5209450721740722,entropy=2.8533995151519775,explained_var_old=0.269,explained_var_new=0.329
batch 1:77, episode_len=15
d1=0.01485,lr_multiplier=0.444,loss=3.510392189025879,entropy=2.903468132019043,explained_var_old=0.344,explained_var_new=0.408
batch 1:78, episode_len=11
d1=0.01367,lr_multiplier=0.444,loss=3.513014316558383,entropy=2.928459465999048,explained_var_old=0.302,explained_var_new=0.394
batch 1:79, episode_len=7
d1=0.01480,lr_multiplier=0.444,loss=3.531136059191895,entropy=2.931120781707764,explained_var_old=0.339,explained_var_new=0.396
batch 1:80, episode_len=9
d1=0.02624,lr_multiplier=0.444,loss=3.526563059638795,entropy=2.921102048665527,explained_var_old=0.330,explained_var_new=0.400
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!!! Aeoloco Powershell Prompt (pytorch)
d:\0.01220_rn_multiplier> 0.444, loss: 3.5790107250212623, entropy: 2.953091693115234, explained_var_old: 0.307, explained_var_new: 0.375
batch 1166, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.5802948474884032, entropy: 2.936488399668372, explained_var_old: 0.310, explained_var_new: 0.389
batch 1171, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.5818548202516465, entropy: 2.9491265634915213, explained_var_old: 0.309, explained_var_new: 0.368
batch 1172, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.5217852592466026, entropy: 2.9213385499662783, explained_var_old: 0.323, explained_var_new: 0.391
batch 1173, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.5289015769953496, entropy: 2.951063198547363, explained_var_old: 0.358, explained_var_new: 0.416
batch 1174, episode_len: 0
d:\0.02092_rn_multiplier> 0.444, loss: 3.530538539595961, entropy: 2.9115610122630964, explained_var_old: 0.298, explained_var_new: 0.396
batch 1175, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.4971108420584472, entropy: 2.907737467193604, explained_var_old: 0.356, explained_var_new: 0.409
batch 1176, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.5209450721749722, entropy: 2.8533995151519775, explained_var_old: 0.269, explained_var_new: 0.329
batch 1177, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.510392189025878, entropy: 2.903468123019043, explained_var_old: 0.344, explained_var_new: 0.408
batch 1178, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.513014105588238, entropy: 2.92549405999048, explained_var_old: 0.308, explained_var_new: 0.394
batch 1179, episode_len: 0
d:\0.01407_rn_multiplier> 0.444, loss: 3.531136039191895, entropy: 2.9311320781707764, explained_var_old: 0.339, explained_var_new: 0.396
batch 1180, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.526300359539795, entropy: 2.911020469665527, explained_var_old: 0.330, explained_var_new: 0.400
batch 1181, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.505418078024292, entropy: 2.890999287033081, explained_var_old: 0.321, explained_var_new: 0.389
batch 1182, episode_len: 0
d:\0.02843_rn_multiplier> 0.667, loss: 3.5001378959387207, entropy: 2.8939707279265322, explained_var_old: 0.327, explained_var_new: 0.393
batch 1183, episode_len: 0
d:\0.02843_rn_multiplier> 0.667, loss: 3.4419031143189477, entropy: 2.87614345505371, explained_var_old: 0.332, explained_var_new: 0.429
batch 1184, episode_len: 0
d:\0.02843_rn_multiplier> 0.667, loss: 3.454668165939355, entropy: 2.88083964953003, explained_var_old: 0.366, explained_var_new: 0.460
batch 1185, episode_len: 0
d:\0.02843_rn_multiplier> 0.667, loss: 3.4223709106465312, entropy: 2.81440591211338, explained_var_old: 0.304, explained_var_new: 0.410
d:\0.02843_rn_multiplier> 0.667, loss: 3.4223709106465312, entropy: 2.81440591211338, explained_var_old: 0.304, explained_var_new: 0.410
batch 1186, episode_len: 0
d:\0.02700_rn_multiplier> 0.667, loss: 3.452946424484253, entropy: 2.882638216018678, explained_var_old: 0.322, explained_var_new: 0.433
batch 1187, episode_len: 0
d:\0.04894_rn_multiplier> 0.444, loss: 3.296957492823836, entropy: 2.8576124753413, explained_var_old: 0.413, explained_var_new: 0.537
batch 1188, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.417028670122925, entropy: 2.823929398446707, explained_var_old: 0.346, explained_var_new: 0.446
batch 1189, episode_len: 0
d:\0.02774_rn_multiplier> 0.444, loss: 3.383701909484803, entropy: 2.8602549529297443, explained_var_old: 0.338, explained_var_new: 0.437
batch 1190, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.505465843444824, entropy: 2.84743357047119, explained_var_old: 0.281, explained_var_new: 0.350
batch 1191, episode_len: 0
d:\0.01868_rn_multiplier> 0.444, loss: 3.393018007278424, entropy: 2.834131716818848, explained_var_old: 0.348, explained_var_new: 0.430
batch 1192, episode_len: 0
d:\0.01940_rn_multiplier> 0.444, loss: 3.411768849433594, entropy: 2.86320020202451, explained_var_old: 0.339, explained_var_new: 0.458
batch 1193, episode_len: 0
d:\0.01870_rn_multiplier> 0.444, loss: 3.404388427734375, entropy: 2.814517021179199, explained_var_old: 0.347, explained_var_new: 0.432
batch 1194, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.4450621604919434, entropy: 2.9025719158002, explained_var_old: 0.388, explained_var_new: 0.453
batch 1195, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.47623116607666, entropy: 2.93075231048534, explained_var_old: 0.354, explained_var_new: 0.427
batch 1196, episode_len: 0
d:\0.01898_rn_multiplier> 0.444, loss: 3.443472822438523, entropy: 2.86586239637535, explained_var_old: 0.339, explained_var_new: 0.411
batch 1197, episode_len: 0
d:\0.01220_rn_multiplier> 0.444, loss: 3.353102922439575, entropy: 2.7997026443148145, explained_var_old: 0.365, explained_var_new: 0.460
batch 1198, episode_len: 0
d:\0.01898_rn_multiplier> 0.444, loss: 3.35839362883794, entropy: 2.78402064935303, explained_var_old: 0.372, explained_var_new: 0.456
batch 1199, episode_len: 0
d:\0.01898_rn_multiplier> 0.444, loss: 3.391478300946045, entropy: 2.814105632275146, explained_var_old: 0.352, explained_var_new: 0.416
batch 1200, episode_len: 0
d:\0.01746_rn_multiplier> 0.444, loss: 3.38498320255127, entropy: 2.8222151756296, explained_var_old: 0.349, explained_var_new: 0.450
current self-rlw batch: 100
```

```
!!! Aeoloco Powershell Prompt (pytorch)
New best policy!!!!!!
batch 1201, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.35238883544922, entropy: 2.7579140663146973, explained_var_old: 0.336, explained_var_new: 0.420
batch 1202, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.3612051010131836, entropy: 2.840118646621704, explained_var_old: 0.373, explained_var_new: 0.443
batch 1203, episode_len: 0
d:\0.01870_rn_multiplier> 0.444, loss: 3.4129221576164795, entropy: 2.8654959774017324, explained_var_old: 0.280, explained_var_new: 0.378
batch 1204, episode_len: 0
d:\0.01870_rn_multiplier> 0.444, loss: 3.27766105123784, entropy: 2.78305101949533, explained_var_old: 0.390, explained_var_new: 0.464
batch 1205, episode_len: 0
d:\0.02013_rn_multiplier> 0.444, loss: 3.37960256576538, entropy: 2.724282741546631, explained_var_old: 0.325, explained_var_new: 0.401
batch 1206, episode_len: 0
d:\0.01853_rn_multiplier> 0.444, loss: 3.297603845963136, entropy: 2.734170913696239, explained_var_old: 0.337, explained_var_new: 0.450
batch 1207, episode_len: 0
d:\0.01853_rn_multiplier> 0.444, loss: 3.2791943550109863, entropy: 2.7737049238089938, explained_var_old: 0.402, explained_var_new: 0.485
batch 1208, episode_len: 0
d:\0.02092_rn_multiplier> 0.444, loss: 3.30835153574712, entropy: 2.7021682839611133, explained_var_old: 0.378, explained_var_new: 0.458
batch 1209, episode_len: 0
d:\0.02092_rn_multiplier> 0.444, loss: 3.253070472131348, entropy: 2.729837417602539, explained_var_old: 0.385, explained_var_new: 0.463
batch 1210, episode_len: 0
d:\0.01810_rn_multiplier> 0.444, loss: 3.30850016784668, entropy: 2.769720727703857, explained_var_old: 0.364, explained_var_new: 0.456
batch 1211, episode_len: 0
d:\0.02104_rn_multiplier> 0.444, loss: 3.267678223846436, entropy: 2.782321313858022, explained_var_old: 0.342, explained_var_new: 0.454
batch 1212, episode_len: 0
d:\0.02107_rn_multiplier> 0.444, loss: 3.18027870727539, entropy: 2.72505521774292, explained_var_old: 0.427, explained_var_new: 0.505
batch 1213, episode_len: 0
d:\0.01746_rn_multiplier> 0.444, loss: 3.21996794555664, entropy: 2.6675586709439453, explained_var_old: 0.400, explained_var_new: 0.502
batch 1214, episode_len: 0
d:\0.01853_rn_multiplier> 0.444, loss: 3.16804823180542, entropy: 2.662691583170166, explained_var_old: 0.402, explained_var_new: 0.473
batch 1215, episode_len: 0
d:\0.01881_rn_multiplier> 0.444, loss: 3.185882904052734, entropy: 2.674546480178333, explained_var_old: 0.359, explained_var_new: 0.445
batch 1216, episode_len: 0
d:\0.02043_rn_multiplier> 0.444, loss: 3.185547828743164, entropy: 2.6726059913635254, explained_var_old: 0.362, explained_var_new: 0.470
batch 1217, episode_len: 0
d:\0.01825_rn_multiplier> 0.444, loss: 3.1899170249152408, entropy: 2.6031289100646973, explained_var_old: 0.357, explained_var_new: 0.464
batch 1218, episode_len: 0
d:\0.02092_rn_multiplier> 0.444, loss: 3.219799063720703, entropy: 2.692631244659424, explained_var_old: 0.358, explained_var_new: 0.458
batch 1219, episode_len: 0
d:\0.02092_rn_multiplier> 0.444, loss: 3.200362873077393, entropy: 2.660744455959288, explained_var_old: 0.351, explained_var_new: 0.446
batch 1220, episode_len: 0
d:\0.01947_rn_multiplier> 0.444, loss: 3.2513251304626465, entropy: 2.6514179706573486, explained_var_old: 0.293, explained_var_new: 0.380
batch 1221, episode_len: 0
d:\0.01830_rn_multiplier> 0.444, loss: 3.2813668251037598, entropy: 2.679013967514038, explained_var_old: 0.344, explained_var_new: 0.428
batch 1222, episode_len: 0
d:\0.02279_rn_multiplier> 0.444, loss: 3.172800779326154, entropy: 2.62883862288377, explained_var_old: 0.350, explained_var_new: 0.458
batch 1223, episode_len: 0
d:\0.02223_rn_multiplier> 0.444, loss: 3.146135091781616, entropy: 2.62554954824829, explained_var_old: 0.385, explained_var_new: 0.481
batch 1224, episode_len: 0
d:\0.01870_rn_multiplier> 0.444, loss: 3.202878713607788, entropy: 2.648851394833203, explained_var_old: 0.363, explained_var_new: 0.453
batch 1225, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.155118644008348, entropy: 2.648116817474385, explained_var_old: 0.385, explained_var_new: 0.468
batch 1226, episode_len: 0
d:\0.02043_rn_multiplier> 0.444, loss: 3.243522366088867, entropy: 2.602067222191958, explained_var_old: 0.324, explained_var_new: 0.408
batch 1227, episode_len: 0
d:\0.02247_rn_multiplier> 0.444, loss: 3.2187644083181958, entropy: 2.613403203125, explained_var_old: 0.300, explained_var_new: 0.411
batch 1228, episode_len: 0
d:\0.02464_rn_multiplier> 0.444, loss: 3.10360449295044, entropy: 2.617387500305176, explained_var_old: 0.373, explained_var_new: 0.480
batch 1229, episode_len: 0
d:\0.01870_rn_multiplier> 0.444, loss: 3.12000703116485, entropy: 2.584478851330566, explained_var_old: 0.395, explained_var_new: 0.480
batch 1230, episode_len: 0
d:\0.01898_rn_multiplier> 0.444, loss: 3.165757654097412, entropy: 2.600420475061035, explained_var_old: 0.351, explained_var_new: 0.464
batch 1231, episode_len: 0
d:\0.02843_rn_multiplier> 0.444, loss: 3.14740224023874, entropy: 2.58926632619995, explained_var_old: 0.331, explained_var_new: 0.445
batch 1232, episode_len: 0
d:\0.01898_rn_multiplier> 0.444, loss: 3.181487312316895, entropy: 2.574923813644409, explained_var_old: 0.355, explained_var_new: 0.428
batch 1233, episode_len: 0
```

```
!! Aeacoda Powershell Prompt (pytho)
d:\> 01889, lr_multiplier=0.444, loss=3.1816487312316896, entropy=2.574922813644409, explained_var_old=0.355, explained_var_new=0.428
batch 1:150, episode_len=9
d:\> 01892, lr_multiplier=0.444, loss=3.156450999780273, entropy=2.606276607513428, explained_var_old=0.299, explained_var_new=0.408
batch 1:154, episode_len=9
d:\> 02219, lr_multiplier=0.444, loss=3.081441879272461, entropy=2.5596821308132988, explained_var_old=0.415, explained_var_new=0.491
batch 1:155, episode_len=12
d:\> 01212, lr_multiplier=0.444, loss=3.07957361286621, entropy=2.4897658824920654, explained_var_old=0.324, explained_var_new=0.430
batch 1:136, episode_len=7
d:\> 01879, lr_multiplier=0.444, loss=3.07807223282125, entropy=2.540416971583135, explained_var_old=0.391, explained_var_new=0.470
batch 1:157, episode_len=9
d:\> 02143, lr_multiplier=0.444, loss=3.106336352093506, entropy=2.571607823142259, explained_var_old=0.328, explained_var_new=0.445
batch 1:158, episode_len=11
d:\> 01617, lr_multiplier=0.444, loss=3.1752567201259766, entropy=2.5749926567077637, explained_var_old=0.286, explained_var_new=0.395
batch 1:139, episode_len=11
d:\> 02069, lr_multiplier=0.444, loss=3.1574282322949, entropy=2.5380215644839456, explained_var_old=0.306, explained_var_new=0.397
batch 1:140, episode_len=11
d:\> 01702, lr_multiplier=0.444, loss=3.08561770685425, entropy=2.551586782077293, explained_var_old=0.340, explained_var_new=0.421
batch 1:141, episode_len=15
d:\> 02210, lr_multiplier=0.444, loss=3.2254142665863037, entropy=2.582516670227051, explained_var_old=0.252, explained_var_new=0.366
batch 1:152, episode_len=9
d:\> 02473, lr_multiplier=0.444, loss=3.1526493844714355, entropy=2.5610289573669434, explained_var_old=0.290, explained_var_new=0.390
batch 1:143, episode_len=11
d:\> 02699, lr_multiplier=0.444, loss=3.124302846074707, entropy=2.571597099304199, explained_var_old=0.381, explained_var_new=0.464
batch 1:154, episode_len=11
d:\> 02024, lr_multiplier=0.444, loss=3.139350891132812, entropy=2.5761120319366455, explained_var_old=0.325, explained_var_new=0.397
batch 1:145, episode_len=11
d:\> 01312, lr_multiplier=0.444, loss=3.10968550140381, entropy=2.502599477679443, explained_var_old=0.302, explained_var_new=0.390
batch 1:146, episode_len=10
d:\> 02109, lr_multiplier=0.444, loss=3.0440187927246, entropy=2.49019653203125, explained_var_old=0.333, explained_var_new=0.429
batch 1:147, episode_len=9
d:\> 02287, lr_multiplier=0.444, loss=3.146829618822613, entropy=2.543467792510986, explained_var_old=0.290, explained_var_new=0.380
batch 1:148, episode_len=11
d:\> 02423, lr_multiplier=0.444, loss=3.00339684295654, entropy=2.44490993242798, explained_var_old=0.404, explained_var_new=0.471
batch 1:149, episode_len=11
d:\> 02322, lr_multiplier=0.444, loss=3.08637238259663, entropy=2.44669008250049, explained_var_old=0.337, explained_var_new=0.432
batch 1:150, episode_len=11
d:\> 02853, lr_multiplier=0.444, loss=3.119874005493164, entropy=2.535318619062368, explained_var_old=0.273, explained_var_new=0.367
current self-play batch: 150
max played=150, min s. loss: 4, t=10
batch 1:151, episode_len=9
d:\> 01487, lr_multiplier=0.444, loss=3.094879570007324, entropy=2.494123458823947, explained_var_old=0.309, explained_var_new=0.381
batch 1:152, episode_len=7
d:\> 02574, lr_multiplier=0.444, loss=3.173046112060547, entropy=2.5585289001464844, explained_var_old=0.298, explained_var_new=0.389
batch 1:153, episode_len=11
d:\> 02685, lr_multiplier=0.444, loss=3.0987846851348877, entropy=2.522991130419922, explained_var_old=0.341, explained_var_new=0.435
batch 1:154, episode_len=11
d:\> 01710, lr_multiplier=0.444, loss=3.053688277349854, entropy=2.447539296289086, explained_var_old=0.318, explained_var_new=0.402
batch 1:155, episode_len=9
d:\> 02087, lr_multiplier=0.444, loss=3.092418121378906, entropy=2.5043596622014453, explained_var_old=0.306, explained_var_new=0.387
batch 1:156, episode_len=8
d:\> 01025, lr_multiplier=0.444, loss=3.284248876716553, entropy=2.448794041760374, explained_var_old=0.405, explained_var_new=0.458
batch 1:157, episode_len=7
d:\> 02481, lr_multiplier=0.444, loss=3.07236652896118, entropy=2.44909328711548, explained_var_old=0.367, explained_var_new=0.434
batch 1:158, episode_len=9
d:\> 01266, lr_multiplier=0.444, loss=3.266224431991577, entropy=2.45783784539551, explained_var_old=0.394, explained_var_new=0.482
batch 1:159, episode_len=11
d:\> 02082, lr_multiplier=0.444, loss=3.105239688825239, entropy=2.505843639373793, explained_var_old=0.284, explained_var_new=0.389
batch 1:160, episode_len=11
d:\> 02841, lr_multiplier=0.444, loss=3.045711360397339, entropy=2.523037910461426, explained_var_old=0.338, explained_var_new=0.444
batch 1:161, episode_len=11
d:\> 02724, lr_multiplier=0.444, loss=3.127824308488037, entropy=2.422350406467235, explained_var_old=0.209, explained_var_new=0.340
batch 1:162, episode_len=15
d:\> 01985, lr_multiplier=0.444, loss=3.265577125493164, entropy=2.421892813924326, explained_var_old=0.374, explained_var_new=0.471
batch 1:163, episode_len=11
d:\> 02452, lr_multiplier=0.444, loss=3.069439646519309, entropy=2.511496782025564, explained_var_old=0.287, explained_var_new=0.375
```

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!! Aeacoda Powershell Prompt (pytho)
d:\> 02083, lr_multiplier=0.444, loss=3.105239688825239, entropy=2.505843639373793, explained_var_old=0.284, explained_var_new=0.389
batch 1:160, episode_len=11
d:\> 02841, lr_multiplier=0.444, loss=3.045711360397339, entropy=2.523037910461426, explained_var_old=0.338, explained_var_new=0.444
batch 1:161, episode_len=11
d:\> 02724, lr_multiplier=0.444, loss=3.127824308488037, entropy=2.422350406467235, explained_var_old=0.209, explained_var_new=0.340
batch 1:162, episode_len=15
d:\> 01985, lr_multiplier=0.444, loss=3.265577125493164, entropy=2.421892813924326, explained_var_old=0.374, explained_var_new=0.471
batch 1:163, episode_len=11
d:\> 02452, lr_multiplier=0.444, loss=3.069439646519309, entropy=2.511496782025564, explained_var_old=0.287, explained_var_new=0.375
batch 1:164, episode_len=11
d:\> 01423, lr_multiplier=0.444, loss=3.069439646519309, entropy=2.511496782025564, explained_var_old=0.287, explained_var_new=0.375
batch 1:165, episode_len=9
d:\> 01403, lr_multiplier=0.296, loss=3.03067231782837, entropy=2.447365016937256, explained_var_old=0.306, explained_var_new=0.404
batch 1:166, episode_len=9
d:\> 01892, lr_multiplier=0.296, loss=3.09652339279541, entropy=2.4227120151519775, explained_var_old=0.393, explained_var_new=0.456
batch 1:167, episode_len=10
d:\> 01074, lr_multiplier=0.296, loss=3.110435962677002, entropy=2.4481072425842285, explained_var_old=0.255, explained_var_new=0.335
batch 1:167, episode_len=10
d:\> 01824, lr_multiplier=0.296, loss=3.291841077804654, entropy=2.3989870985412598, explained_var_old=0.347, explained_var_new=0.418
batch 1:168, episode_len=12
d:\> 01423, lr_multiplier=0.296, loss=3.136842727661133, entropy=2.494535795592028, explained_var_old=0.291, explained_var_new=0.340
batch 1:169, episode_len=9
d:\> 01540, lr_multiplier=0.296, loss=3.10389382716075, entropy=2.468501091003418, explained_var_old=0.290, explained_var_new=0.356
batch 1:170, episode_len=9
d:\> 01767, lr_multiplier=0.296, loss=3.032946109771728, entropy=2.4174132347109934, explained_var_old=0.333, explained_var_new=0.390
batch 1:171, episode_len=7
d:\> 01190, lr_multiplier=0.296, loss=3.019568129038088, entropy=2.419417142888042, explained_var_old=0.318, explained_var_new=0.381
batch 1:172, episode_len=9
d:\> 01020, lr_multiplier=0.296, loss=3.028919932244404, entropy=2.4981079959898385, explained_var_old=0.339, explained_var_new=0.398
batch 1:173, episode_len=10
d:\> 02699, lr_multiplier=0.444, loss=3.0243834991186523, entropy=2.413546322776245, explained_var_old=0.333, explained_var_new=0.404
batch 1:174, episode_len=10
d:\> 02483, lr_multiplier=0.444, loss=3.2615123981207278, entropy=2.322170099613037, explained_var_old=0.283, explained_var_new=0.383
batch 1:175, episode_len=9
d:\> 01946, lr_multiplier=0.444, loss=3.007895465026855, entropy=2.379461238421484, explained_var_old=0.279, explained_var_new=0.370
batch 1:176, episode_len=9
d:\> 01069, lr_multiplier=0.444, loss=3.288665307495117, entropy=2.43921160697937, explained_var_old=0.274, explained_var_new=0.386
batch 1:177, episode_len=11
d:\> 01069, lr_multiplier=0.444, loss=3.288665307495117, entropy=2.43921160697937, explained_var_old=0.274, explained_var_new=0.386
batch 1:178, episode_len=9
d:\> 02024, lr_multiplier=0.444, loss=3.039299949987793, entropy=2.373334163878174, explained_var_old=0.274, explained_var_new=0.360
batch 1:179, episode_len=8
d:\> 02091, lr_multiplier=0.444, loss=3.29841356274658, entropy=2.37708759103943, explained_var_old=0.296, explained_var_new=0.370
batch 1:180, episode_len=11
d:\> 01818, lr_multiplier=0.444, loss=3.232003974914551, entropy=2.385120153427124, explained_var_old=0.321, explained_var_new=0.429
batch 1:181, episode_len=11
d:\> 01775, lr_multiplier=0.444, loss=3.2605724811553955, entropy=2.3690913876989633, explained_var_old=0.359, explained_var_new=0.416
batch 1:182, episode_len=11
d:\> 01880, lr_multiplier=0.444, loss=3.26150279645105, entropy=2.357064942304088, explained_var_old=0.288, explained_var_new=0.391
batch 1:183, episode_len=9
d:\> 01725, lr_multiplier=0.444, loss=3.2674973487854004, entropy=2.3704545497894287, explained_var_old=0.299, explained_var_new=0.382
batch 1:184, episode_len=7
d:\> 01797, lr_multiplier=0.444, loss=3.0212503479552223, entropy=2.363296882111816, explained_var_old=0.213, explained_var_new=0.294
batch 1:185, episode_len=8
d:\> 02510, lr_multiplier=0.444, loss=3.270790396199951, entropy=2.37783032915208, explained_var_old=0.242, explained_var_new=0.365
batch 1:186, episode_len=11
d:\> 02112, lr_multiplier=0.444, loss=3.2474055767059326, entropy=2.226262678221436, explained_var_old=0.243, explained_var_new=0.344
batch 1:187, episode_len=12
d:\> 02223, lr_multiplier=0.444, loss=3.276939916010718, entropy=2.3586878776550293, explained_var_old=0.330, explained_var_new=0.398
batch 1:188, episode_len=9
d:\> 02025, lr_multiplier=0.444, loss=3.060495138168335, entropy=2.35382041168213, explained_var_old=0.204, explained_var_new=0.208
batch 1:189, episode_len=9
d:\> 01915, lr_multiplier=0.444, loss=3.242285068825684, entropy=2.3561694620309795, explained_var_old=0.329, explained_var_new=0.398
batch 1:190, episode_len=12
d:\> 01995, lr_multiplier=0.444, loss=3.2348698139190674, entropy=2.35193308657715, explained_var_old=0.378, explained_var_new=0.458
batch 1:191, episode_len=11
d:\> 01185, lr_multiplier=0.444, loss=3.261227838293457, entropy=2.315819501876331, explained_var_old=0.296, explained_var_new=0.384
batch 1:192, episode_len=10
```

```
!!! Aeoncode Powershell Prompt (pytorch)
d:\0.02381_r multiplier=0.444, loss=2.99841352774658, entropy=2.377068753010943, explained_var_old=0.296, explained_var_new=0.370
batch 1:190, episode_len=3
d:\0.01816_r multiplier=0.444, loss=2.952003974914551, entropy=2.385120153427124, explained_var_old=0.321, explained_var_new=0.429
batch 1:211, episode_len=11
d:\0.01375_r multiplier=0.444, loss=2.965724811553955, entropy=2.3690919876989632, explained_var_old=0.359, explained_var_new=0.416
batch 1:182, episode_len=18
d:\0.01829_r multiplier=0.444, loss=2.96150279045105, entropy=2.357069492349088, explained_var_old=0.288, explained_var_new=0.391
batch 1:183, episode_len=9
d:\0.01783_r multiplier=0.444, loss=2.9674973487854004, entropy=2.3704545497894287, explained_var_old=0.299, explained_var_new=0.382
batch 1:184, episode_len=7
d:\0.01797_r multiplier=0.444, loss=3.0212502479553223, entropy=2.3628296852111816, explained_var_old=0.213, explained_var_new=0.294
batch 1:185, episode_len=3
d:\0.02510_r multiplier=0.444, loss=2.97090388199951, entropy=2.37763032913208, explained_var_old=0.242, explained_var_new=0.365
batch 1:186, episode_len=11
d:\0.02115_r multiplier=0.444, loss=2.947495576705926, entropy=2.3282692788221436, explained_var_old=0.242, explained_var_new=0.344
batch 1:187, episode_len=11
d:\0.02029_r multiplier=0.444, loss=2.9786399166107178, entropy=2.358687776550292, explained_var_old=0.330, explained_var_new=0.398
batch 1:188, episode_len=14
d:\0.02918_r multiplier=0.444, loss=2.060495138168235, entropy=2.353882041168213, explained_var_old=0.204, explained_var_new=0.308
batch 1:189, episode_len=9
d:\0.01915_r multiplier=0.444, loss=2.942285068825684, entropy=2.3561694622039795, explained_var_old=0.329, explained_var_new=0.398
batch 1:190, episode_len=3
d:\0.01895_r multiplier=0.444, loss=2.8348988139190674, entropy=2.351935386657715, explained_var_old=0.378, explained_var_new=0.458
batch 1:191, episode_len=11
d:\0.02165_r multiplier=0.444, loss=2.961227893293457, entropy=2.315819501876831, explained_var_old=0.298, explained_var_new=0.384
batch 1:192, episode_len=11
d:\0.02872_r multiplier=0.444, loss=2.9308204959878996, entropy=2.3579797744759977, explained_var_old=0.334, explained_var_new=0.398
batch 1:193, episode_len=18
d:\0.02898_r multiplier=0.444, loss=2.9573471549170996, entropy=2.32528116027832, explained_var_old=0.253, explained_var_new=0.369
batch 1:194, episode_len=11
d:\0.02223_r multiplier=0.444, loss=2.8665161123125, entropy=2.3125483989715576, explained_var_old=0.323, explained_var_new=0.427
batch 1:195, episode_len=3
d:\0.02542_r multiplier=0.444, loss=2.990551471710205, entropy=2.239966203094482, explained_var_old=0.287, explained_var_new=0.354
batch 1:196, episode_len=3
d:\0.02373_r multiplier=0.444, loss=3.012966192626952, entropy=2.381235996178223, explained_var_old=0.230, explained_var_new=0.334
batch 1:197, episode_len=11
d:\0.02675_r multiplier=0.444, loss=2.934182949718018, entropy=2.287326281290518, explained_var_old=0.305, explained_var_new=0.400
batch 1:198, episode_len=11
d:\0.02880_r multiplier=0.444, loss=2.9260754335266112, entropy=2.227384199039307, explained_var_old=0.274, explained_var_new=0.353
batch 1:199, episode_len=12
d:\0.02290_r multiplier=0.444, loss=2.867883874816896, entropy=2.3033923244171143, explained_var_old=0.331, explained_var_new=0.421
batch 1:200, episode_len=10
d:\0.02905_r multiplier=0.444, loss=2.94371843330127, entropy=2.295201539992286, explained_var_old=0.283, explained_var_new=0.355
current self-play batch: 200
maxELOouts:1000, win: 6, loss: 4, tie:0
batch 1:201, episode_len=10
d:\0.02440_r multiplier=0.444, loss=2.8904006576530806, entropy=2.219973087310791, explained_var_old=0.287, explained_var_new=0.382
batch 1:202, episode_len=11
d:\0.02324_r multiplier=0.444, loss=2.8941640499249268, entropy=2.3132030963897705, explained_var_old=0.333, explained_var_new=0.409
batch 1:203, episode_len=7
d:\0.02096_r multiplier=0.444, loss=2.8335537910461426, entropy=2.267760753631592, explained_var_old=0.355, explained_var_new=0.439
batch 1:204, episode_len=8
d:\0.01745_r multiplier=0.444, loss=2.840977430343628, entropy=2.238135814666748, explained_var_old=0.356, explained_var_new=0.432
batch 1:205, episode_len=10
d:\0.01848_r multiplier=0.444, loss=2.912707567214966, entropy=2.2531983852384475, explained_var_old=0.201, explained_var_new=0.364
batch 1:206, episode_len=14
d:\0.01902_r multiplier=0.444, loss=2.8466176980694336, entropy=2.2623198879821777, explained_var_old=0.303, explained_var_new=0.400
batch 1:207, episode_len=7
d:\0.01707_r multiplier=0.444, loss=2.890657424926758, entropy=2.2698865631103516, explained_var_old=0.288, explained_var_new=0.386
batch 1:208, episode_len=9
d:\0.02758_r multiplier=0.444, loss=2.80995621109009, entropy=2.229334115820257, explained_var_old=0.322, explained_var_new=0.425
batch 1:209, episode_len=11
d:\0.02011_r multiplier=0.444, loss=2.819202184977124, entropy=2.234832479279123, explained_var_old=0.299, explained_var_new=0.381
batch 1:210, episode_len=11
d:\0.02500_r multiplier=0.444, loss=2.9028587341308594, entropy=2.255294036865224, explained_var_old=0.270, explained_var_new=0.354
batch 1:211, episode_len=11
d:\0.02130_r multiplier=0.444, loss=2.879481554031372, entropy=2.2196977138519287, explained_var_old=0.277, explained_var_new=0.382
batch 1:212, episode_len=10
d:\0.01882_r multiplier=0.444, loss=2.866109609603882, entropy=2.2234930992126465, explained_var_old=0.291, explained_var_new=0.372
batch 1:213, episode_len=3
d:\0.02115_r multiplier=0.444, loss=2.831659554351807, entropy=2.31312441253967, explained_var_old=0.315, explained_var_new=0.421
batch 1:214, episode_len=11
d:\0.02425_r multiplier=0.444, loss=2.831659482711792, entropy=2.237684321697754, explained_var_old=0.292, explained_var_new=0.367
batch 1:215, episode_len=11
d:\0.02465_r multiplier=0.444, loss=2.7639445796238086, entropy=2.1465270296494, explained_var_old=0.299, explained_var_new=0.397
batch 1:216, episode_len=9
d:\0.02484_r multiplier=0.444, loss=2.8078231547546387, entropy=2.218423618545322, explained_var_old=0.314, explained_var_new=0.421
batch 1:217, episode_len=11
d:\0.02281_r multiplier=0.444, loss=2.8196303844451904, entropy=2.192799911391113, explained_var_old=0.323, explained_var_new=0.389
batch 1:218, episode_len=12
d:\0.02171_r multiplier=0.444, loss=2.823952193023545, entropy=2.191520751037598, explained_var_old=0.280, explained_var_new=0.363
batch 1:219, episode_len=12
d:\0.02004_r multiplier=0.444, loss=2.84657219833667, entropy=2.213466219207764, explained_var_old=0.243, explained_var_new=0.357
batch 1:220, episode_len=10
d:\0.02828_r multiplier=0.444, loss=2.8639583837646454, entropy=2.183866577911377, explained_var_old=0.269, explained_var_new=0.362
batch 1:221, episode_len=14
d:\0.02892_r multiplier=0.444, loss=2.8460826365616, entropy=2.160897244202695, explained_var_old=0.251, explained_var_new=0.354
batch 1:222, episode_len=19
d:\0.02612_r multiplier=0.444, loss=2.76554775230371, entropy=2.205229792162086, explained_var_old=0.343, explained_var_new=0.428
batch 1:223, episode_len=15
d:\0.04655_r multiplier=0.296, loss=2.799182178589966, entropy=2.224148824929654, explained_var_old=0.257, explained_var_new=0.367
batch 1:224, episode_len=7
d:\0.01467_r multiplier=0.296, loss=2.8111071536608887, entropy=2.24013614654541, explained_var_old=0.294, explained_var_new=0.389
batch 1:225, episode_len=10
d:\0.00961_r multiplier=0.296, loss=2.750241758439209, entropy=2.15910506484741, explained_var_old=0.359, explained_var_new=0.413
batch 1:226, episode_len=14
d:\0.01850_r multiplier=0.296, loss=2.678534393310547, entropy=2.089759660720825, explained_var_old=0.345, explained_var_new=0.431
batch 1:227, episode_len=14
d:\0.01786_r multiplier=0.296, loss=2.772911071773438, entropy=2.14433884206665, explained_var_old=0.315, explained_var_new=0.374
batch 1:228, episode_len=11
d:\0.01485_r multiplier=0.296, loss=2.715953568873, entropy=2.129172897338867, explained_var_old=0.313, explained_var_new=0.376
batch 1:229, episode_len=14
```

```
!!! Aeoncode Powershell Prompt (pytorch)
d:\0.02675_r multiplier=0.444, loss=2.934182949718018, entropy=2.2387356281290518, explained_var_old=0.305, explained_var_new=0.400
batch 1:230, episode_len=11
d:\0.02898_r multiplier=0.444, loss=2.9260754335266112, entropy=2.327936410903907, explained_var_old=0.274, explained_var_new=0.358
batch 1:199, episode_len=11
d:\0.02921_r multiplier=0.444, loss=2.867883874816896, entropy=2.3033923244171143, explained_var_old=0.331, explained_var_new=0.421
batch 1:200, episode_len=10
d:\0.02905_r multiplier=0.444, loss=2.94371843330127, entropy=2.295201539992286, explained_var_old=0.283, explained_var_new=0.355
current self-play batch: 200
maxELOouts:1000, win: 6, loss: 4, tie:0
batch 1:201, episode_len=10
d:\0.02440_r multiplier=0.444, loss=2.8904006576530806, entropy=2.219973087310791, explained_var_old=0.287, explained_var_new=0.382
batch 1:202, episode_len=11
d:\0.02324_r multiplier=0.444, loss=2.8941640499249268, entropy=2.3132030963897705, explained_var_old=0.333, explained_var_new=0.409
batch 1:203, episode_len=7
d:\0.02096_r multiplier=0.444, loss=2.8335537910461426, entropy=2.267760753631592, explained_var_old=0.355, explained_var_new=0.439
batch 1:204, episode_len=8
d:\0.01745_r multiplier=0.444, loss=2.840977430343628, entropy=2.238135814666748, explained_var_old=0.356, explained_var_new=0.432
batch 1:205, episode_len=10
d:\0.01848_r multiplier=0.444, loss=2.912707567214966, entropy=2.2531983852384475, explained_var_old=0.201, explained_var_new=0.364
batch 1:206, episode_len=14
d:\0.01902_r multiplier=0.444, loss=2.8466176980694336, entropy=2.2623198879821777, explained_var_old=0.303, explained_var_new=0.400
batch 1:207, episode_len=7
d:\0.01707_r multiplier=0.444, loss=2.890657424926758, entropy=2.2698865631103516, explained_var_old=0.288, explained_var_new=0.386
batch 1:208, episode_len=9
d:\0.02758_r multiplier=0.444, loss=2.80995621109009, entropy=2.229334115820257, explained_var_old=0.322, explained_var_new=0.425
batch 1:209, episode_len=11
d:\0.02011_r multiplier=0.444, loss=2.819202184977124, entropy=2.234832479279123, explained_var_old=0.299, explained_var_new=0.381
batch 1:210, episode_len=11
d:\0.02500_r multiplier=0.444, loss=2.9028587341308594, entropy=2.255294036865224, explained_var_old=0.270, explained_var_new=0.354
batch 1:211, episode_len=11
d:\0.02130_r multiplier=0.444, loss=2.879481554031372, entropy=2.2196977138519287, explained_var_old=0.277, explained_var_new=0.382
batch 1:212, episode_len=10
d:\0.01882_r multiplier=0.444, loss=2.866109609603882, entropy=2.2234930992126465, explained_var_old=0.291, explained_var_new=0.372
batch 1:213, episode_len=3
d:\0.02115_r multiplier=0.444, loss=2.831659554351807, entropy=2.31312441253967, explained_var_old=0.315, explained_var_new=0.421
batch 1:214, episode_len=11
d:\0.02425_r multiplier=0.444, loss=2.831659482711792, entropy=2.237684321697754, explained_var_old=0.292, explained_var_new=0.367
batch 1:215, episode_len=11
d:\0.02465_r multiplier=0.444, loss=2.7639445796238086, entropy=2.1465270296494, explained_var_old=0.299, explained_var_new=0.397
batch 1:216, episode_len=9
d:\0.02484_r multiplier=0.444, loss=2.8078231547546387, entropy=2.218423618545322, explained_var_old=0.314, explained_var_new=0.421
batch 1:217, episode_len=11
d:\0.02281_r multiplier=0.444, loss=2.8196303844451904, entropy=2.192799911391113, explained_var_old=0.323, explained_var_new=0.389
batch 1:218, episode_len=12
d:\0.02171_r multiplier=0.444, loss=2.823952193023545, entropy=2.191520751037598, explained_var_old=0.280, explained_var_new=0.363
batch 1:219, episode_len=12
d:\0.02004_r multiplier=0.444, loss=2.84657219833667, entropy=2.213466219207764, explained_var_old=0.243, explained_var_new=0.357
batch 1:220, episode_len=10
d:\0.02828_r multiplier=0.444, loss=2.8639583837646454, entropy=2.183866577911377, explained_var_old=0.269, explained_var_new=0.362
batch 1:221, episode_len=14
d:\0.02892_r multiplier=0.444, loss=2.8460826365616, entropy=2.160897244202695, explained_var_old=0.251, explained_var_new=0.354
batch 1:222, episode_len=19
d:\0.02612_r multiplier=0.444, loss=2.76554775230371, entropy=2.205229792162086, explained_var_old=0.343, explained_var_new=0.428
batch 1:223, episode_len=15
d:\0.04655_r multiplier=0.296, loss=2.799182178589966, entropy=2.224148824929654, explained_var_old=0.257, explained_var_new=0.367
batch 1:224, episode_len=7
d:\0.01467_r multiplier=0.296, loss=2.8111071536608887, entropy=2.24013614654541, explained_var_old=0.294, explained_var_new=0.389
batch 1:225, episode_len=10
d:\0.00961_r multiplier=0.296, loss=2.750241758439209, entropy=2.15910506484741, explained_var_old=0.359, explained_var_new=0.413
batch 1:226, episode_len=14
d:\0.01850_r multiplier=0.296, loss=2.678534393310547, entropy=2.089759660720825, explained_var_old=0.345, explained_var_new=0.431
batch 1:227, episode_len=14
d:\0.01786_r multiplier=0.296, loss=2.772911071773438, entropy=2.14433884206665, explained_var_old=0.315, explained_var_new=0.374
batch 1:228, episode_len=11
d:\0.01485_r multiplier=0.296, loss=2.715953568873, entropy=2.129172897338867, explained_var_old=0.313, explained_var_new=0.376
batch 1:229, episode_len=14
```

```
msf6 > multi(0, 296, loss:2.67353433310547, entropy:2.08575960720825, explained_var_old:0.345, explained_var_new:0.431
batch 1:227, episode_len:4
d1:0.01860, lr_multiplier:0.296, loss:2.772911071773438, entropy:2.14433846206665, explained_var_old:0.315, explained_var_new:0.374
batch 1:228, episode_len:11
d1:0.01485, lr_multiplier:0.296, loss:2.7159535683573, entropy:2.127917289723867, explained_var_old:0.313, explained_var_new:0.376
batch 1:229, episode_len:11
d1:0.01307, lr_multiplier:0.296, loss:2.816967437335205, entropy:2.14413779067993, explained_var_old:0.203, explained_var_new:0.291
batch 1:230, episode_len:3
d1:0.01760, lr_multiplier:0.296, loss:2.8169217109680176, entropy:2.16347599029541, explained_var_old:0.286, explained_var_new:0.347
batch 1:231, episode_len:11
d1:0.02174, lr_multiplier:0.296, loss:2.741388593414207, entropy:2.11656442269744, explained_var_old:0.292, explained_var_new:0.349
batch 1:232, episode_len:10
d1:0.02925, lr_multiplier:0.296, loss:2.760234662246704, entropy:2.149159982946777, explained_var_old:0.274, explained_var_new:0.368
batch 1:233, episode_len:3
d1:0.02544, lr_multiplier:0.296, loss:2.760479638644409, entropy:2.091337680166504, explained_var_old:0.322, explained_var_new:0.374
batch 1:234, episode_len:10
d1:0.01894, lr_multiplier:0.296, loss:2.818913495777832, entropy:2.1396987433201904, explained_var_old:0.267, explained_var_new:0.325
batch 1:235, episode_len:3
d1:0.01561, lr_multiplier:0.296, loss:2.7063913346336914, entropy:2.08500514084131, explained_var_old:0.277, explained_var_new:0.363
batch 1:236, episode_len:3
d1:0.01621, lr_multiplier:0.296, loss:2.722915878326416, entropy:2.129334413234424, explained_var_old:0.349, explained_var_new:0.410
batch 1:237, episode_len:11
d1:0.01868, lr_multiplier:0.296, loss:2.62903046079712, entropy:2.136380910873413, explained_var_old:0.355, explained_var_new:0.407
batch 1:238, episode_len:3
d1:0.01204, lr_multiplier:0.296, loss:2.691171169231006, entropy:2.092141389468918, explained_var_old:0.334, explained_var_new:0.427
batch 1:239, episode_len:10
d1:0.01821, lr_multiplier:0.296, loss:2.643249286499023, entropy:2.0713484237261963, explained_var_old:0.337, explained_var_new:0.426
batch 1:240, episode_len:7
d1:0.02700, lr_multiplier:0.296, loss:2.7370288372039796, entropy:2.051082564783301, explained_var_old:0.334, explained_var_new:0.413
batch 1:241, episode_len:7
d1:0.02046, lr_multiplier:0.296, loss:2.71154117842285, entropy:2.104423854827831, explained_var_old:0.347, explained_var_new:0.398
batch 1:242, episode_len:7
d1:0.02550, lr_multiplier:0.296, loss:2.6741702556610107, entropy:2.073381135531616, explained_var_old:0.344, explained_var_new:0.401
batch 1:243, episode_len:9
d1:0.02823, lr_multiplier:0.296, loss:2.569808790084839, entropy:2.0173443722534, explained_var_old:0.369, explained_var_new:0.433
batch 1:244, episode_len:11
d1:0.01348, lr_multiplier:0.296, loss:2.626202495480957, entropy:2.069402931207275, explained_var_old:0.299, explained_var_new:0.384
batch 1:245, episode_len:10
d1:0.01624, lr_multiplier:0.296, loss:2.78497332949829, entropy:2.1455595703125, explained_var_old:0.283, explained_var_new:0.364
batch 1:246, episode_len:7
d1:0.01618, lr_multiplier:0.296, loss:2.6878304481506348, entropy:2.12421894469197, explained_var_old:0.343, explained_var_new:0.406
batch 1:247, episode_len:11
d1:0.02345, lr_multiplier:0.296, loss:2.7781412601470947, entropy:2.085887193678096, explained_var_old:0.231, explained_var_new:0.311
batch 1:248, episode_len:11
d1:0.01996, lr_multiplier:0.296, loss:2.64810443244995, entropy:2.118238108602744, explained_var_old:0.270, explained_var_new:0.457
batch 1:249, episode_len:10
d1:0.01882, lr_multiplier:0.296, loss:2.718238074456884, entropy:2.071601776123047, explained_var_old:0.238, explained_var_new:0.347
batch 1:250, episode_len:3
d1:0.01712, lr_multiplier:0.296, loss:2.580839933776855, entropy:2.06059611831665, explained_var_old:0.371, explained_var_new:0.432
current_sdl:var batch: 250
num_playouts:1000, win: 5, loss: 5, tie:0
batch 1:251, episode_len:3
d1:0.01067, lr_multiplier:0.296, loss:2.71256160736084, entropy:2.1012838894987395, explained_var_old:0.307, explained_var_new:0.383
batch 1:252, episode_len:10
d1:0.00911, lr_multiplier:0.444, loss:2.6084723472595215, entropy:2.036787271499634, explained_var_old:0.353, explained_var_new:0.444
batch 1:253, episode_len:16
d1:0.02461, lr_multiplier:0.444, loss:2.7152485847473145, entropy:2.119488477706909, explained_var_old:0.346, explained_var_new:0.439
batch 1:254, episode_len:11
d1:0.02841, lr_multiplier:0.444, loss:2.67292963871338, entropy:2.08674597595215, explained_var_old:0.304, explained_var_new:0.410
batch 1:255, episode_len:11
d1:0.02112, lr_multiplier:0.444, loss:2.6546760599823, entropy:2.042995929180176, explained_var_old:0.281, explained_var_new:0.381
batch 1:256, episode_len:10
d1:0.03111, lr_multiplier:0.444, loss:2.545248031616211, entropy:2.07522369915283, explained_var_old:0.397, explained_var_new:0.479
batch 1:257, episode_len:7
d1:0.01872, lr_multiplier:0.444, loss:2.63733835614014, entropy:2.040765443428589, explained_var_old:0.296, explained_var_new:0.408
batch 1:258, episode_len:10
```

```
msf6 > multi(0, 296, loss:2.6084723472595215, entropy:2.036787271499634, explained_var_old:0.353, explained_var_new:0.444
batch 1:259, episode_len:10
d1:0.02461, lr_multiplier:0.444, loss:2.7152485847473145, entropy:2.119488477706909, explained_var_old:0.346, explained_var_new:0.439
batch 1:260, episode_len:11
d1:0.02841, lr_multiplier:0.444, loss:2.67292963871338, entropy:2.08674597595215, explained_var_old:0.304, explained_var_new:0.410
batch 1:261, episode_len:11
d1:0.02112, lr_multiplier:0.444, loss:2.6546760599823, entropy:2.042995929180176, explained_var_old:0.281, explained_var_new:0.381
batch 1:262, episode_len:10
d1:0.03111, lr_multiplier:0.444, loss:2.545248031616211, entropy:2.07522369915283, explained_var_old:0.397, explained_var_new:0.479
batch 1:263, episode_len:7
d1:0.01872, lr_multiplier:0.444, loss:2.63733835614014, entropy:2.040765443428589, explained_var_old:0.296, explained_var_new:0.408
batch 1:264, episode_len:3
d1:0.02594, lr_multiplier:0.444, loss:2.64799354605713, entropy:2.07466509880078, explained_var_old:0.320, explained_var_new:0.427
batch 1:265, episode_len:10
d1:0.02911, lr_multiplier:0.444, loss:2.627253293991089, entropy:2.0223705768585205, explained_var_old:0.336, explained_var_new:0.438
batch 1:266, episode_len:7
d1:0.02783, lr_multiplier:0.444, loss:2.51380233813477, entropy:2.0191171169231006, explained_var_old:0.418, explained_var_new:0.504
batch 1:267, episode_len:12
d1:0.00940, lr_multiplier:0.444, loss:2.53939301824961, entropy:1.998923609642467, explained_var_old:0.340, explained_var_new:0.439
batch 1:268, episode_len:11
d1:0.02924, lr_multiplier:0.444, loss:2.607308578032447, entropy:2.04218743242798, explained_var_old:0.378, explained_var_new:0.476
batch 1:269, episode_len:3
d1:0.01982, lr_multiplier:0.444, loss:2.5049304902152303, entropy:2.0659714317321777, explained_var_old:0.395, explained_var_new:0.484
batch 1:270, episode_len:11
d1:0.01911, lr_multiplier:0.444, loss:2.510144948993506, entropy:2.047039443913574, explained_var_old:0.363, explained_var_new:0.489
batch 1:271, episode_len:7
d1:0.02678, lr_multiplier:0.444, loss:2.505890369415283, entropy:2.0998423957824707, explained_var_old:0.393, explained_var_new:0.493
batch 1:272, episode_len:3
d1:0.02882, lr_multiplier:0.444, loss:2.5356760025024414, entropy:2.035860061645508, explained_var_old:0.387, explained_var_new:0.506
batch 1:273, episode_len:3
d1:0.04820, lr_multiplier:0.296, loss:2.5310988429208496, entropy:2.0416650772094727, explained_var_old:0.389, explained_var_new:0.511
batch 1:274, episode_len:9
d1:0.01823, lr_multiplier:0.296, loss:2.6070189476013184, entropy:2.042983092224883, explained_var_old:0.398, explained_var_new:0.406
batch 1:275, episode_len:9
d1:0.02410, lr_multiplier:0.296, loss:2.533459118655395, entropy:2.0146353244781494, explained_var_old:0.360, explained_var_new:0.463
batch 1:276, episode_len:9
d1:0.01465, lr_multiplier:0.296, loss:2.545095026562744, entropy:2.0005368802215576, explained_var_old:0.405, explained_var_new:0.461
batch 1:277, episode_len:12
d1:0.01770, lr_multiplier:0.296, loss:2.55788413932373, entropy:2.0671210289001465, explained_var_old:0.372, explained_var_new:0.466
batch 1:278, episode_len:9
d1:0.01485, lr_multiplier:0.296, loss:2.583184719085692, entropy:2.017606182064705, explained_var_old:0.338, explained_var_new:0.431
batch 1:279, episode_len:3
d1:0.01856, lr_multiplier:0.296, loss:2.65906287322998, entropy:2.050145142320967, explained_var_old:0.276, explained_var_new:0.384
batch 1:280, episode_len:12
d1:0.01830, lr_multiplier:0.296, loss:2.524622917175293, entropy:2.042442083287646, explained_var_old:0.391, explained_var_new:0.466
batch 1:281, episode_len:10
d1:0.01482, lr_multiplier:0.296, loss:2.47925294494629, entropy:1.983680889129639, explained_var_old:0.441, explained_var_new:0.502
batch 1:282, episode_len:11
```

```
Python Shell Prompt (pytorch)
batch 1:226, episode_len:9
d1:0.02410, lr_multiplier:0.296, loss:2.533459188553955, entropy:2.0146353244781494, explained_var_old:0.360, explained_var_new:0.463
batch 1:227, episode_len:9
d1:0.01405, lr_multiplier:0.296, loss:2.545096206562744, entropy:2.0005366802215576, explained_var_old:0.405, explained_var_new:0.461
batch 1:228, episode_len:10
d1:0.01770, lr_multiplier:0.296, loss:2.557984113922273, entropy:2.0471210289001465, explained_var_old:0.372, explained_var_new:0.466
batch 1:229, episode_len:9
d1:0.01445, lr_multiplier:0.296, loss:2.583184719085693, entropy:2.0170605192647705, explained_var_old:0.338, explained_var_new:0.431
batch 1:230, episode_len:8
d1:0.01856, lr_multiplier:0.296, loss:2.659095237322998, entropy:2.050145149230957, explained_var_old:0.276, explained_var_new:0.384
batch 1:231, episode_len:12
d1:0.01528, lr_multiplier:0.296, loss:2.534622917175293, entropy:2.0424420823537646, explained_var_old:0.391, explained_var_new:0.466
batch 1:232, episode_len:12
d1:0.01462, lr_multiplier:0.296, loss:2.479225294494629, entropy:1.982668089129639, explained_var_old:0.441, explained_var_new:0.502
batch 1:233, episode_len:11
d1:0.01824, lr_multiplier:0.296, loss:2.642045442199707, entropy:2.0139449542720713, explained_var_old:0.375, explained_var_new:0.457
batch 1:234, episode_len:10
d1:0.01871, lr_multiplier:0.296, loss:2.45413032537842, entropy:2.048400640487671, explained_var_old:0.459, explained_var_new:0.520
batch 1:235, episode_len:7
d1:0.01862, lr_multiplier:0.296, loss:2.497470857128906, entropy:2.0147714614982164, explained_var_old:0.424, explained_var_new:0.479
batch 1:236, episode_len:9
d1:0.01670, lr_multiplier:0.296, loss:2.53882786118164, entropy:1.9305812120437822, explained_var_old:0.343, explained_var_new:0.413
batch 1:237, episode_len:9
d1:0.01665, lr_multiplier:0.296, loss:2.574469804763794, entropy:2.010213613510132, explained_var_old:0.379, explained_var_new:0.457
batch 1:238, episode_len:11
d1:0.01605, lr_multiplier:0.296, loss:2.544921398162842, entropy:2.004930257797241, explained_var_old:0.362, explained_var_new:0.437
batch 1:239, episode_len:7
d1:0.01822, lr_multiplier:0.296, loss:2.554934024810791, entropy:2.0168912410736084, explained_var_old:0.346, explained_var_new:0.435
batch 1:240, episode_len:11
d1:0.01897, lr_multiplier:0.296, loss:2.4851419925809697, entropy:1.9877214567565918, explained_var_old:0.410, explained_var_new:0.484
batch 1:241, episode_len:10
d1:0.01856, lr_multiplier:0.296, loss:2.5654852390229307, entropy:2.0209431643254395, explained_var_old:0.350, explained_var_new:0.427
batch 1:242, episode_len:12
d1:0.01207, lr_multiplier:0.296, loss:2.47350359630127, entropy:1.95272958278656, explained_var_old:0.429, explained_var_new:0.495
batch 1:243, episode_len:9
d1:0.01624, lr_multiplier:0.296, loss:2.4348783029785156, entropy:1.9592092037200928, explained_var_old:0.385, explained_var_new:0.479
batch 1:244, episode_len:9
d1:0.01112, lr_multiplier:0.296, loss:2.6126178995129395, entropy:1.978957211669922, explained_var_old:0.310, explained_var_new:0.385
batch 1:245, episode_len:10
d1:0.01874, lr_multiplier:0.296, loss:2.521240490722656, entropy:1.907940149207251, explained_var_old:0.328, explained_var_new:0.428
batch 1:246, episode_len:11
d1:0.02895, lr_multiplier:0.296, loss:2.557979463216853, entropy:1.9943251609802246, explained_var_old:0.388, explained_var_new:0.468
batch 1:247, episode_len:11
d1:0.01861, lr_multiplier:0.296, loss:2.5453431608292725, entropy:2.0321171283721924, explained_var_old:0.397, explained_var_new:0.477
batch 1:248, episode_len:17
d1:0.02214, lr_multiplier:0.296, loss:2.5359201567077637, entropy:1.98679454421997, explained_var_old:0.363, explained_var_new:0.442
current self-play batch: 300
```

训练结果每五十次会自动保存结果一次，以上及为我对 AI 进行 300 次训练的全部参数。通过简易的训练，可以大致观测出，随着训练场数的增加，AI 的胜率也在增加。管中窥豹，可见一斑。市面上最强的阿尔法狗，经过庞大的训练学习，胜率可想而知，其难求一败是归功于强的机器学习能力已经庞大的训练场数。

### 三、实验结果

我对其中的 human\_play.py 代码进行运行，得到了如图 2 界面：

```
D:\python\python.exe
Player 1 with X
Player 2 with O

  0   1   2   3   4   5   6   7
7  -  -  -  -  -  -  -  -
6  -  -  -  -  -  -  -  -
5  -  -  -  -  -  -  -  -
4  -  -  -  -  -  -  -  -
3  -  -  -  0  -  -  -  -
2  -  -  -  -  -  -  -  -
1  -  -  -  -  -  -  -  -
0  -  -  -  -  -  -  -  -

Your move: _
```

于是我简单进行了如图 3 的人机对战：

```
D:\python\python.exe
Player 1 with X
Player 2 with O

  0   1   2   3   4   5   6   7
7  _   _   _   _   _   _   _   _
6  _   X   _   _   0   _   0   _
5  _   _   0   X   X   0   _   _
4  _   _   X   0   0   0   0   X
3  _   _   _   _   0   X   _   X
2  _   _   _   X   0   X   _   _
1  _   _   _   _   0   _   _   _
0  _   _   _   _   X   _   _   _

Your move:  _
```

通过在 your more 后输入自己的下棋位置，来进行人机对战，0 位机器所下的棋，x 为我下的位置，对战过程由于篇幅限制暂时省略。通过与 AI 的对战，可以见得 AI 在训练后不俗的实力。

#### 四、实验总结

在运行代码过程中，我了解到了机器学习的一部分运行环境。以及在使用 python, pytorch 等程序时，了解到英特尔处理器以及英伟达显卡的强大，也知道了 AMD 的处理器以及显卡，在最新一代才陆续支持部分机器学习。但是想要真正研究大型的机器学习代码，还是需要专业的运算型显卡。通过这次机器学习大作业我也算是窥得机器学习的门道，也间接了解到了 AI 的强大。其强大在各个方面，包括出色的学习能力，优秀的适应能力以及机器独有的那一份“专注力”。总之，机器学习作为人工智能的一部分，在未来依然会有极大的发展空间，依然有许多值得我去探索的知识。