Reporting results

Best Run showed as below:

BestRun(run_id='02ccc7ab', objective=0.8, hyperparameters={'learning_rate': 2.49816047538945e-05})

```
== Status ==
Current time: 2022-03-09 23:12:43 (running for 00:45:15.55)
Memory usage on this node: 6.9/29.2 GiB
Using FIFO scheduling algorithm.
Resources requested: 0/8 CPUs, 0/1 GPUs, 0.0/15.13 GiB heap, 0.0/7.56 GiB objects (0.0/1.0 accelerator_type:V100)
Result logdir: /home/yp2201/ray_results/_objective_2022-03-09_22-27-27
Number of trials: 5/5 (5 TERMINATED)
+--------------------+------------+-----------------+-----------------+-------------+
| Trial name         | status     | loc             |   learning_rate |   objective |
|--------------------+------------+-----------------+-----------------+-------------|
| _objective_02ccc7ab | TERMINATED | 10.144.0.41:6869 |     2.49816e-05 |    0.8      |
| _objective_04037305 | TERMINATED | 10.144.0.41:6870 |     4.80286e-05 |    0.626911 |
| _objective_49583cc5 | TERMINATED | 10.144.0.41:6876 |     3.92798e-05 |    0.626911 |
| _objective_8ed0c20f | TERMINATED | 10.144.0.41:6873 |     3.39463e-05 |    0.626911 |
| _objective_d3193fec | TERMINATED | 10.144.0.41:6872 |     1.23233e-05 |    0.794495 |
+--------------------+------------+-----------------+-----------------+-------------+


(_objective pid=6872) {'train_runtime': 529.8788, 'train_samples_per_second': 53.373, 'train_steps_per_second': 6.675,
100%|██████████| 3537/3537 [08:49<00:00,  6.68it/s]
2022-03-09 23:12:43,448 INFO tune.py:639 -- Total run time: 2715.69 seconds (2715.51 seconds for the tuning loop).
BestRun(run_id='02ccc7ab', objective=0.8, hyperparameters={'learning_rate': 2.49816047538945e-05})
```

There were some same results among models, but some were different(Better objective). Objective value didn't vary a lot, but some were different.

For each models, I didn't found relationship that are showing higher loss with better evaluation accuracy of f1 score. Detailed result for each models are as below:

```
1) trial_id: d3193fec,
eval_loss: 0.6119393110275269,
eval_accuracy: 0.7944954128440367
eval_f1: 0.8386167146974064

2) trial_id: 8ed0c20f,
eval_loss: 0.6606119871139526,
eval_accuracy: 0.6269113149847095
eval_f1: 0.7706766917293233


3) trial_id: 49583cc5,
eval_loss: 0.6606153249740601,
eval_accuracy: 0.6269113149847095
eval_f1: 0.7706766917293233


4) trial_id: 04037305,
eval_loss: 0.6604805588722229,
eval_accuracy: 0.6269113149847095,
eval_f1: 0.7706766917293233


5) trial_id: 02ccc7ab,
eval_loss: 0.6439625024795532,
eval_accuracy: 0.8
eval_f1: 0.8439140811455847
```

1)

```
Result for _objective_d3193fec:
  date: 2022-03-09_23-12-43
  done: true
  epoch: 3.0
  eval_accuracy: 0.7944954128440367
  eval_f1: 0.8386167146974064
  eval_loss: 0.6119393110275269
  eval_precision: 0.825922421948912
  eval_recall: 0.8517073170731707
  eval_runtime: 7.9285
  eval_samples_per_second: 206.219
  eval_steps_per_second: 25.856
  experiment_id: 2a13a2bdd7144d2b992add00818942f0
  experiment_tag: 5_learning_rate=1.2323e-05
  hostname: b-3-478
  iterations_since_restore: 3
  node_ip: 10.144.0.41
  objective: 0.7944954128440367
  pid: 6872
  time_since_restore: 536.7909739017487
  time_this_iter_s: 176.52394318580627
  time_total_s: 536.7909739017487
  timestamp: 1646885563
  timesteps_since_restore: 0
  training_iteration: 3
  trial_id: d3193fec
```

2)

```
Result for _objective_8ed0c20f:
  date: 2022-03-09_23-03-42
  done: true
  epoch: 3.0
  eval_accuracy: 0.6269113149847095
  eval_f1: 0.7706766917293233
  eval_loss: 0.6606119871139526
  eval_precision: 0.6269113149847095
  eval_recall: 1.0
  eval_runtime: 7.9072
  eval_samples_per_second: 206.774
  eval_steps_per_second: 25.926
  experiment_id: 78c3a2f7220f464095c24d5fe0464b96
  experiment_tag: 4_learning_rate=3.3946e-05
  hostname: b-3-478
  iterations_since_restore: 3
  node_ip: 10.144.0.41
  objective: 0.6269113149847095
  pid: 6873
  time_since_restore: 536.5737283229828
  time_this_iter_s: 175.4327733516693
  time_total_s: 536.5737283229828
  timestamp: 1646885022
  timesteps_since_restore: 0
  training_iteration: 3
  trial_id: 8ed0c20f
```

3)

```
Result for _objective_49583cc5:
  date: 2022-03-09_22-54-41
  done: true
  epoch: 3.0
  eval_accuracy: 0.6269113149847095
  eval_f1: 0.7706766917293233
  eval_loss: 0.6606153249740601
  eval_precision: 0.6269113149847095
  eval_recall: 1.0
  eval_runtime: 7.8931
  eval_samples_per_second: 207.144
  eval_steps_per_second: 25.972
  experiment_id: 70c2603f50174519b0c761282f57fdc2
  experiment_tag: 3_learning_rate=3.928e-05
  hostname: b-3-478
  iterations_since_restore: 3
  node_ip: 10.144.0.41
  objective: 0.6269113149847095
  pid: 6876
  time_since_restore: 537.295191526413
  time_this_iter_s: 177.53025126457214
  time_total_s: 537.295191526413
  timestamp: 1646884481
  timesteps_since_restore: 0
  training_iteration: 3
  trial_id: 49583cc5
```

4)

```
Result for _objective_04037305:
  date: 2022-03-09_22-45-39
  done: true
  epoch: 3.0
  eval_accuracy: 0.6269113149847095
  eval_f1: 0.7706766917293233
  eval_loss: 0.6604805588722229
  eval_precision: 0.6269113149847095
  eval_recall: 1.0
  eval_runtime: 7.9589
  eval_samples_per_second: 205.432
  eval_steps_per_second: 25.757
  experiment_id: 97ae1ad26ae049059a3a64d57aa04d83
  experiment_tag: 2_learning_rate=4.8029e-05
  hostname: b-3-478
  iterations_since_restore: 3
  node_ip: 10.144.0.41
  objective: 0.6269113149847095
  pid: 6870
  time_since_restore: 541.5577754974365
  time_this_iter_s: 178.10860872268677
  time_total_s: 541.5577754974365
  timestamp: 1646883939
  timesteps_since_restore: 0
  training_iteration: 3
  trial_id: '04037305'
```

5)

```
Result for _objective_02ccc7ab:
  date: 2022-03-09_22-36-32
  done: true
  epoch: 3.0
  eval_accuracy: 0.8
  eval_f1: 0.8439140811455847
  eval_loss: 0.6439625024795532
  eval_precision: 0.8261682242990654
  eval_recall: 0.8624390243902439
  eval_runtime: 8.0144
  eval_samples_per_second: 204.008
  eval_steps_per_second: 25.579
  experiment_id: fb22afdc89c8449a843c9d88637e9862
  experiment_tag: 1_learning_rate=2.4982e-05
  hostname: b-3-478
  iterations_since_restore: 3
  node_ip: 10.144.0.41
  objective: 0.8
  pid: 6869
  time_since_restore: 542.820440530777
  time_this_iter_s: 178.6421868801117
  time_total_s: 542.820440530777
  timestamp: 1646883392
  timesteps_since_restore: 0
  training_iteration: 3
  trial_id: 02ccc7ab
```

*** Extra Credit:**
- I've tried (random)grid search, and results were worse than Bayesian optimization. (Code is included as extra_credit_run_hyperparameter_search.py)

- Grid Search
Advantage: It is well-known tuning method, and public packages are easy to use
Disadvantage: It tries combination of model in every data without any probability(or likelihood) and this should be inefficient.

- Bayesian optimization:
Advantage: Bayesian optimization should be more close to optimal, as it follows the probability when trying different models
Disadvantage: Public packages can be difficult to use.