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Distributed Hyperparameter Searching in Ray Tune

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Background

Hyperparameter selection in machine learning is very important

Many hyperparameter searching algorithms have been developed

- Bayesian Optimization
- Random search
- Grid Search

Where does Ray Tune come in?

Ray

- Framework for distributed ML workloads
- Tasks
    - Invocations of functions to be executed asynchronously on different Python workers
- Actors
    - A stateful worker for Python objects
- Objects
    - Tasks and actors compute on these

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Where does Ray Tune come in?

Tune

- Implemented on top of Ray
- A framework for distributed hyperparameter optimization / model selection
- Integrates multiple SOTA hyperparameter search algorithms
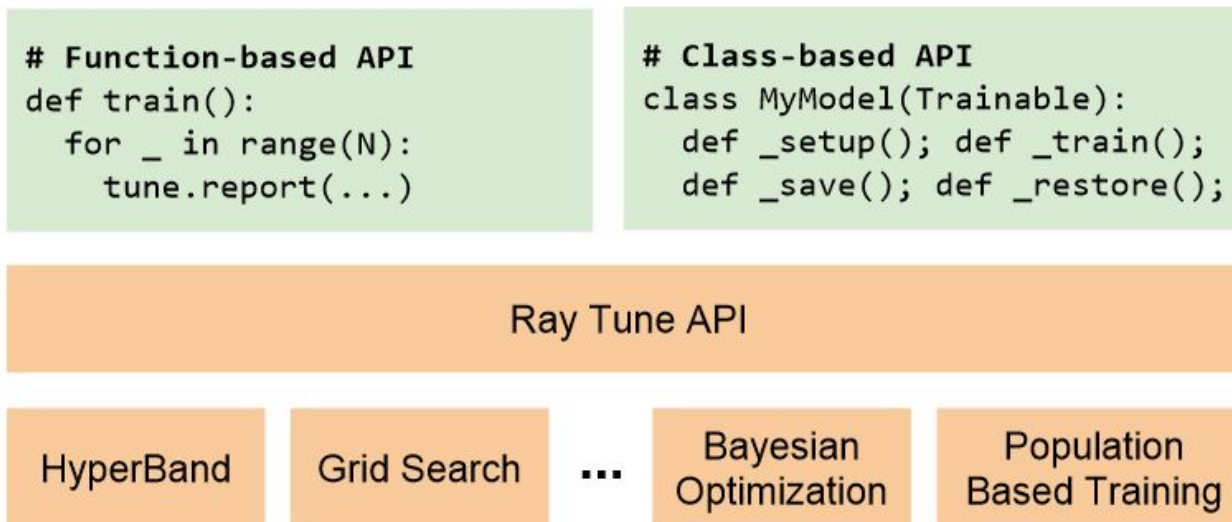
Significance of Ray Tune

Ray Tune offers

1. A unified framework for users to tune hyperparameters using different SOTA algorithms and implementations
   - Distributed
2. A framework for researchers to implement their own hyperparameter tuning algorithms
3. Additional features
   - Monitor and visualize trial progress

This Project

1. Explore capabilities of distributed tuning using Ray Tune
   a. Test out performance of Ray Tune for distributed training using several datasets and several tuning algorithms
2. Implement Structured Bayesian Optimization for specific models
   a. from BOAT
   b. Instead of using a generic GP as prior, use contextual information to create a probabilistic model about the performance
   c. Converge faster & better parameters found
3. Implement generic SBO (similar to BOAT) that allows users to define their own probabilistic models for SBO
   a. Using an open source Python probabilistic model library

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What I have done so far

Read papers

Understand papers

Read code

Understand code

Check feasibility

Future Work

Explore distributed training capabilities of Ray

Run experiments with Normal BO & other methods

Implement structured BO

Run experiments with Structured BO

Compare BO vs SBO (non-distributed & distributed)

Write report

Questions & Suggestions?