Open Source Vizier: Distributed Infrastructure and API for Reliable and Flexible Blackbox Optimization

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Google Brain

Code: https://github.com/google/vizier

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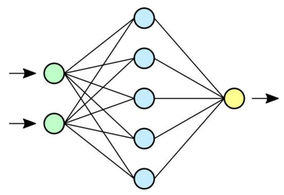
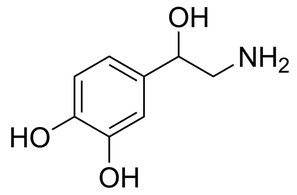
Motivation

The many scenarios of blackbox optimization

ML Hyperparameter Tuning



Chemical/Biological



Cookie Recipes!

Different Evaluation:
Latencies
Budgets
Synchronization

Use a Service!

API

```python
from vizier import StudyConfig, VizierClient

config = StudyConfig() # Search space, metrics, and algorithm.
root = config.search_space.select_root() # "Root" params must exist in every trial.
root.add_float('learning_rate', min=1e-4, max=1e-2, scale='LOG')
root.add_int('num_layers', min=1, max=5)
config.metrics.add('accuracy', goal='MAXIMIZE', min=0.0, max=1.0)
config.algorithm = 'RANDOM_SEARCH'

client = VizierClient.load_or_create_study(
    'cifar10', config, client_id=sys.argv[1]) # Each client should use a unique id.

while suggestions := client.get_suggestions(count=1)
  # Evaluate the suggestion(s) and report the results to Vizier.
  for trial in suggestions:
    metrics = _evaluate_trial(trial.parameters)
    client.complete_trial(metrics, trial_id=trial.id)
```

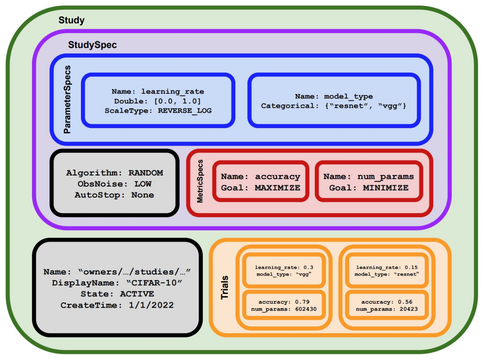
User Client API

```python
from vizier.pythia import Policy, PolicySupporter, SuggestRequest, SuggestDecisions

class MyPolicy(Policy):
  def __init__(self, policy_supporter: PolicySupporter):
    self.policy_supporter = policy_supporter  # Used to obtain old trials.

  def suggest(self, request: SuggestRequest) -> SuggestDecisions:
    """Suggests trials to be evaluated."""
    Xs, y = _trials_to_np_arrays(self.policy_supporter.GetTrials(
        status='COMPLETED')) # Use COMPLETED trials only.
    model = _train_gp(Xs, y)
    return _optimize_ei(model, request.study_config.search_space)
```

Developer Algorithm API

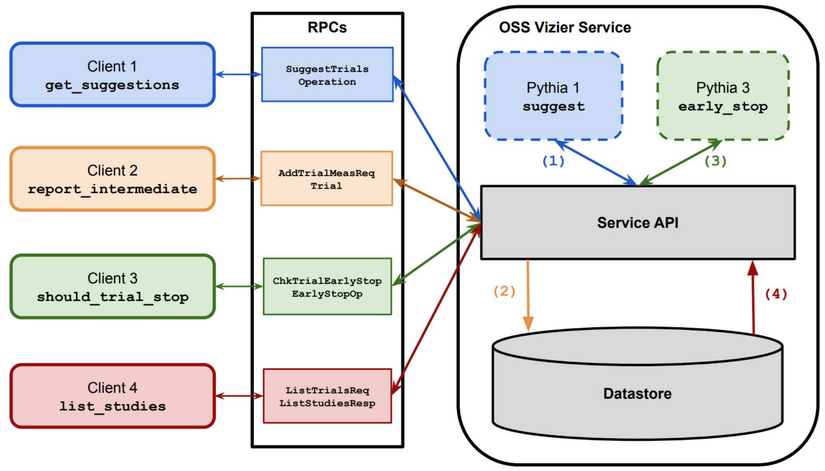


Primitives

Infrastructure

Server-Client:

1. Client sends RPC Request
2. Server starts Pythia
3. Client pings on status
4. Client receives suggestion



OSS Vizier Distributed Pipeline

protobuf
Protocol Buffers

gRPC
A high performance, open source universal RPC framework

Platform + Language Independent Clients

SQL

SQL Datastore for Fault Recovery

Integrations

Vertex Vizier: Use production algorithms

PyGlove: Use evolutionary algorithms

AutoRL: Tune RL agents