Mango: A Python Library for Parallel Hyperparameter Tuning
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1- Hyperparameter Tuning

• Hyperparameters heavily impact the ML algorithms.
• Grid search and Random search
• Waste resources and may not even find optimal configurations.

2- Mango: Hyperparameter Tuning at Scale

Mango: Used in production at Arm Research
• Hyperparameter tuning parallelly on cluster.
• Deployed on Kubernetes cluster using celery.
• Adaptive exploration/exploitation.
• Specify complex search spaces
• Compatibility with Scikit and Scipy.
• Pluggable architecture and ease of usage.
• Fault tolerance for cluster deployment.

Existing Libraries: Hyperopt, Auto-sklearn, Auto-WEKA
• Not designed for production cluster
• Missing feature: Fault tolerance, Job scheduling challenges, Parallel search, Compatibility.
• Assumes specific kind of platform/workers are running or are totally manual.

3- Hyperparameter Tuning Example

• SVM: IRIS Dataset (using 2 features)
• Grid search for: C and Gamma
• Best accuracy: 82%

Grid Search: 58,500 Iterations

4- Mango Internals: Gaussian Process

Gaussian Process

\[
\mathcal{X} \sim \mathcal{N}(\mu(X), \Sigma)
\]

Choose \( x_t = \text{argmax}_{x \in D} |\mu(x) + \Sigma^{1/2} \mathcal{N}(x)| \)

• Adaptive Exploration
• Batch evaluation: Hallucination and Clustering

5- Mango Simple Example

```python
from mango import scheduler, Tuner
param_space = dict(x=range(-10, 10))
@scheduler.serial
def objective(x):
    return x * x
tuner = Tuner(param_space, objective)
results = tuner.minimize()
print(results["best_params"],
results["best_objective"])
```

6- Comparisons

• Sklearn’s Wine Data
• XGBoost Classifier: Mango vs Random vs HyperOpt
• Mean of 20 experiments.

7- Conclusion

• Github: https://github.com/ARM-software/mango
• Mango provides state of art parallel optimizers
• Development: hyperparameters across a set of models.
• More comparisons and examples available on Github.