AWS Certified Machine Learning Engineer - Associate Exam Guide

# Section 2.4 — Tune Models (In-Depth)

This section covers hyperparameter tuning techniques, tools, and best practices to improve model performance. It emphasizes systematic approaches to finding optimal hyperparameters and AWS services for automation.

## 1. Hyperparameters vs Parameters

• Parameters → learned during training (weights, biases)

• Hyperparameters → set before training (learning rate, batch size, # of layers, regularization strength)

## 2. Tuning Strategies

• Grid Search → exhaustive search over combinations (costly)

• Random Search → random combinations, faster, often more effective than grid search

• Bayesian Optimization → probabilistic model to guide exploration of hyperparameter space

• Early stopping → terminate poor-performing runs to save cost

## 3. Best Practices

• Define clear objective metric (accuracy, F1, RMSE, etc.) before tuning

• Use validation sets or cross-validation to ensure robustness

• Monitor for overfitting while tuning

• Apply regularization where needed

• Consider search space carefully (log scale for learning rate, etc.)

## 4. AWS Services

• SageMaker Automatic Model Tuning (HPO) → manages parallel tuning jobs with Bayesian optimization

• SageMaker Autopilot → automatically explores hyperparameters for baseline models

• SageMaker Debugger → monitors training jobs and tuning jobs to detect issues

• SageMaker Experiments → track tuning jobs and compare results

## 5. Refinement Considerations

• Use early stopping in HPO to cut unpromising jobs

• Reuse previous tuning results to guide future tuning

• Manage cost with parallel jobs and resource allocation

• Tune key hyperparameters first (learning rate, batch size) before secondary ones

## ✅ Exam Tips

• SageMaker Automatic Model Tuning = main AWS service for HPO

• Define objective metric clearly for tuning jobs

• Random search often outperforms grid search in efficiency

• Bayesian optimization = best balance of exploration vs exploitation

• Early stopping saves cost/time in tuning jobs

• Hyperparameters are exam focus (not model parameters)