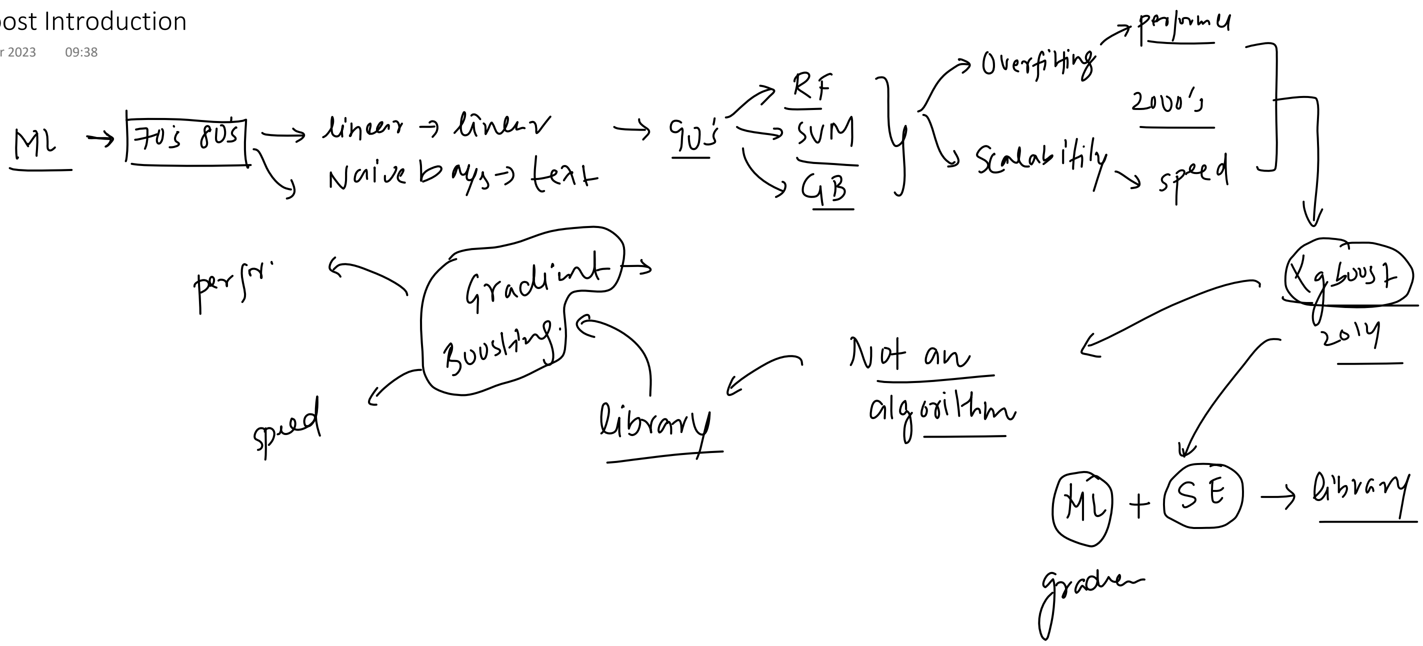
XGBoost Introduction

12 October 2023 09:38



History

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Early Days → Kaggle pe bawaal → [Open source days] ←

→ (2014)

[Gradient Boostings]

- flexibity (Loss function)
  - reg
  - class
  - ranking
  - custom
- → performance
- → Robust
  - → missing value
  - → Regu
  - perform
  - big data
- → Kaggle → GB

(2016)

- → Higgs Boson comp (won)
- → 2011 → 29 winning
  - ↓ 16 → Xgboost

2023 → Xgboost
- → perf
- → speed

Tianqi
- feature
- Optimiza
- multiple / prog
- documenta
- Kaggle

XGBoost Features

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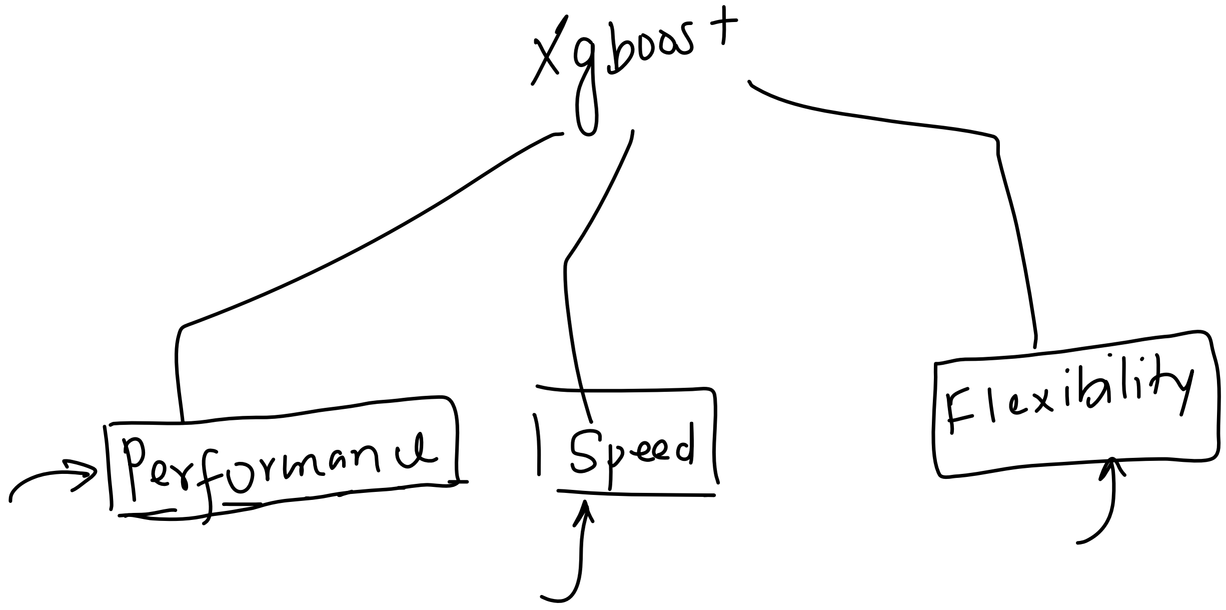

1. Flexibility

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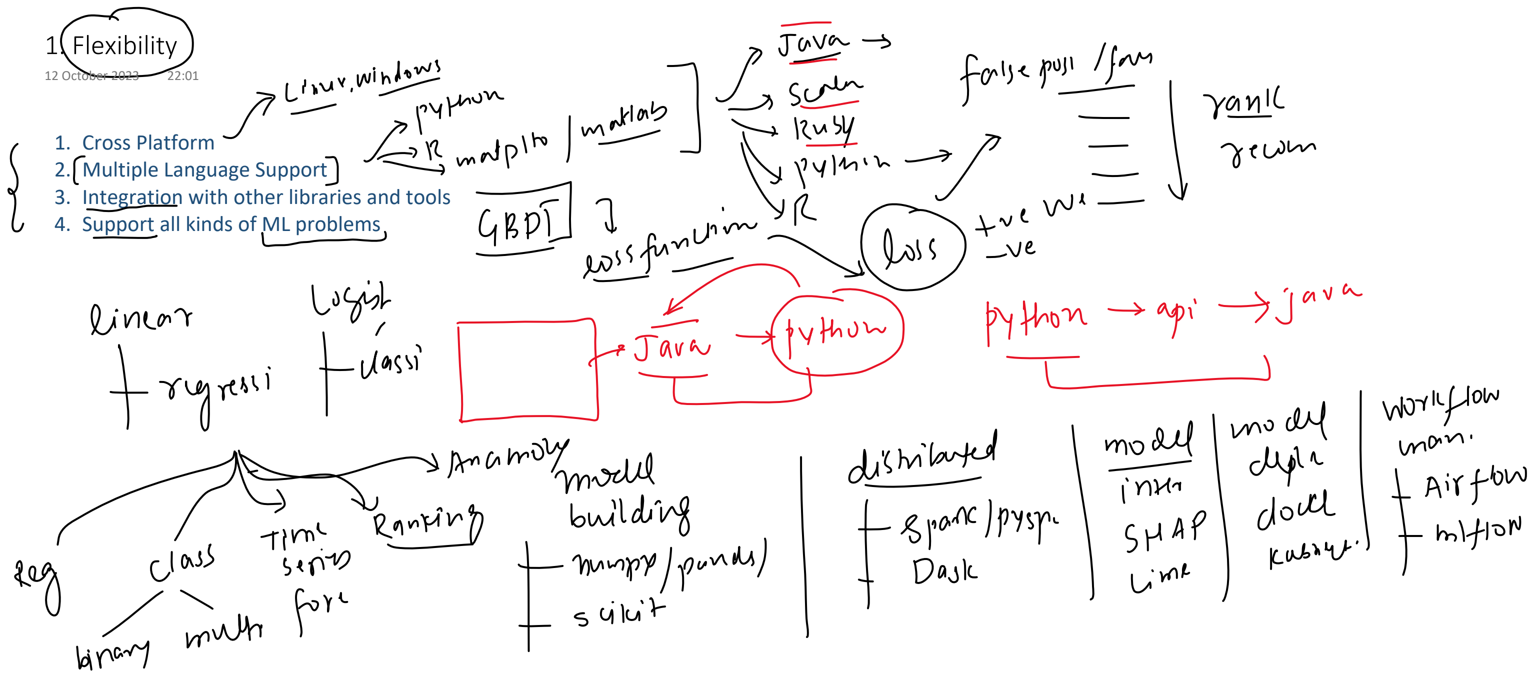
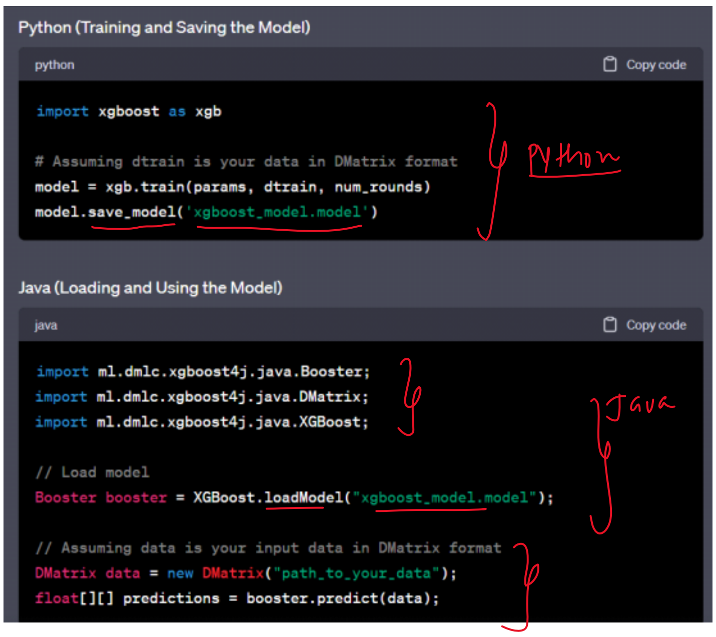
1. Cross Platform
2. Multiple Language Support
3. Integration with other libraries and tools
4. Support all kinds of ML problems





Python (Training and Saving the Model)

```python
import xgboost as xgb

# Assuming dtrain is your data in DMatrix format
model = xgb.train(params, dtrain, num_rounds)
model.save_model('xgboost_model.model')
```

Java (Loading and Using the Model)

```java
import ml.dmlc.xgboost4j.java.Booster;
import ml.dmlc.xgboost4j.java.DMatrix;
import ml.dmlc.xgboost4j.java.XGBoost;

// Load model
Booster booster = XGBoost.loadModel("xgboost_model.model");

// Assuming data is your input data in DMatrix format
DMatrix data = new DMatrix("path_to_your_data");
float[][] predictions = booster.predict(data);
```

2. Speed

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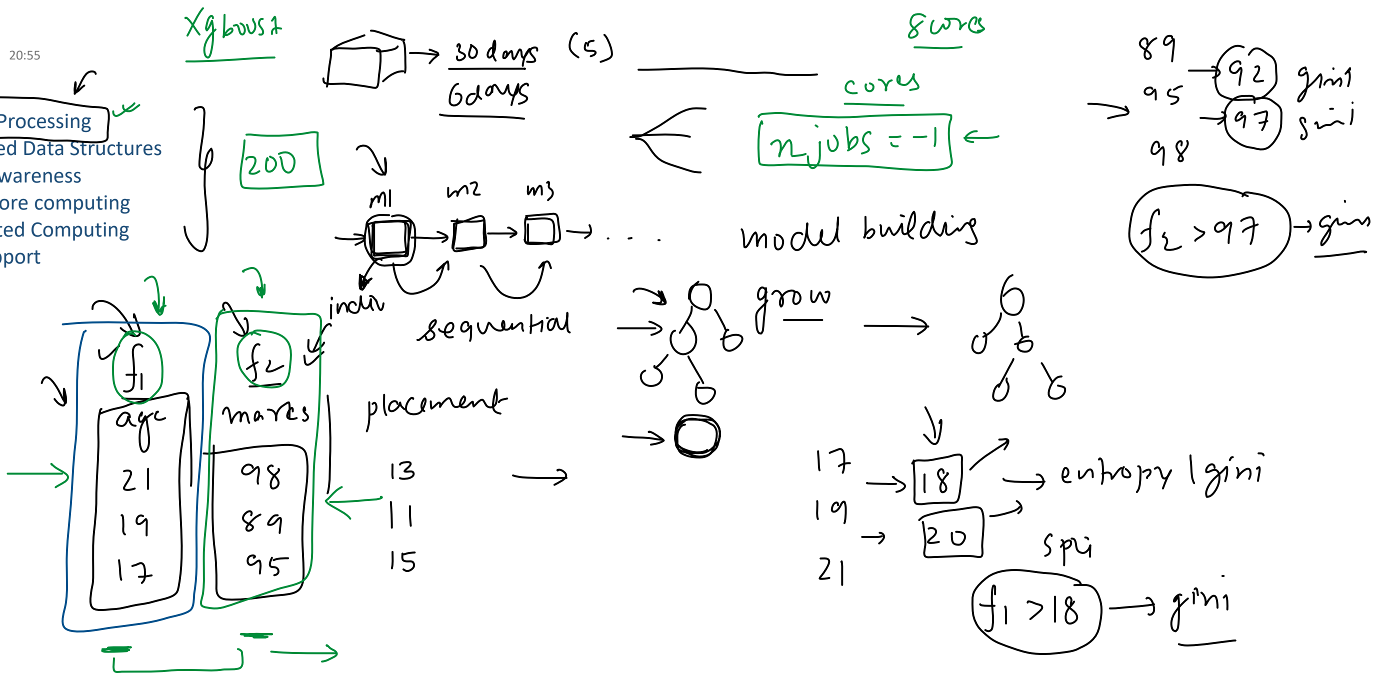
1. Parallel Processing
2. Optimized Data Structures
3. Cache Awareness
4. Out of Core computing
5. Distributed Computing
6. GPU Support



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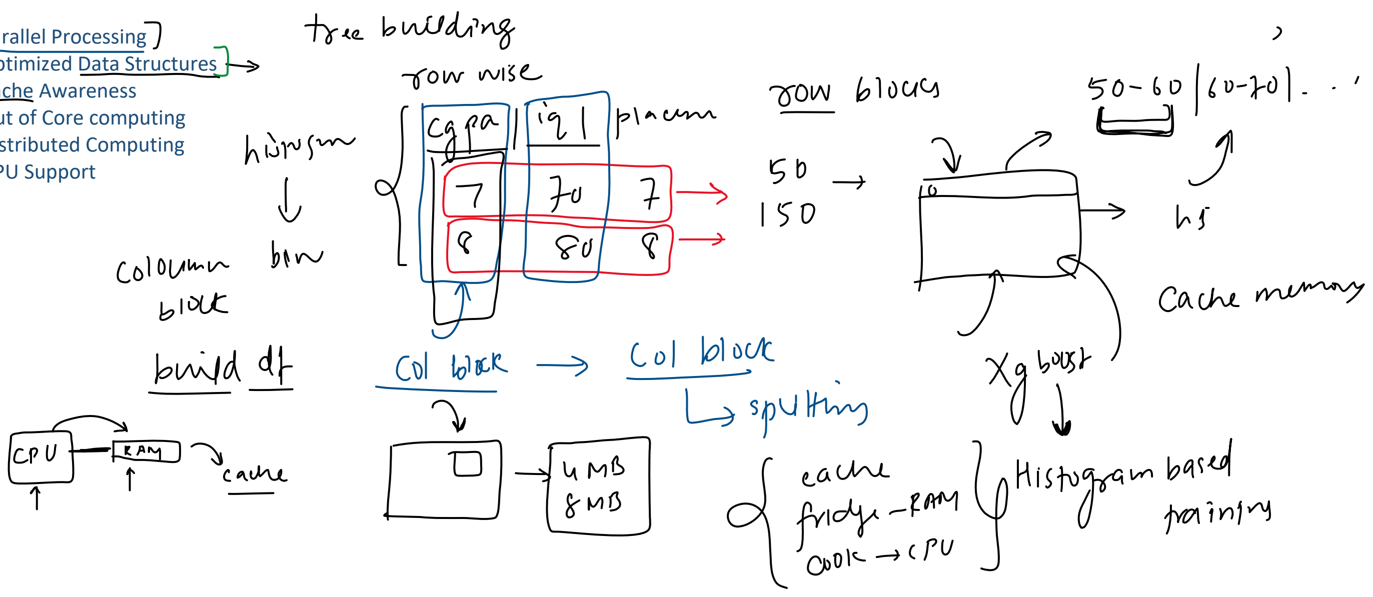

1. Parallel Processing ✓
2. Optimized Data Structures ✓
3. Cache Awareness ✓
4. Out of Core computing
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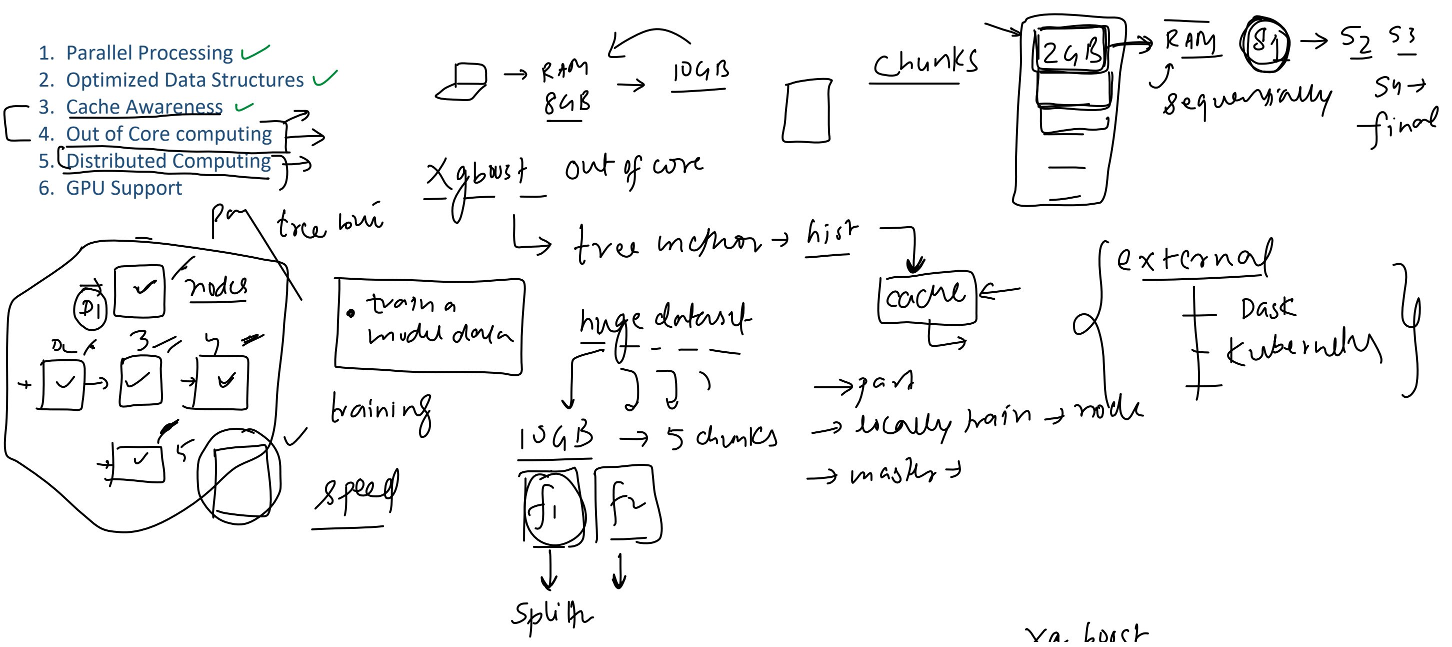
6. GPU Support



Split

software → Extreme

software

Xg boost
Extreme GB

1. Parallel Processing ✓
2. Optimized Data Structures ✓
3. Cache Awareness ✓
4. Out of Core computing ✓
5. Distributed Computing ✓
→ 6. GPU Support →

CPU → data → CPU → GPU
↳ cores → less powerful
more in number

parallel
histogram split finding

tree_method: gpu_hist

software eng
↓
ML → performance

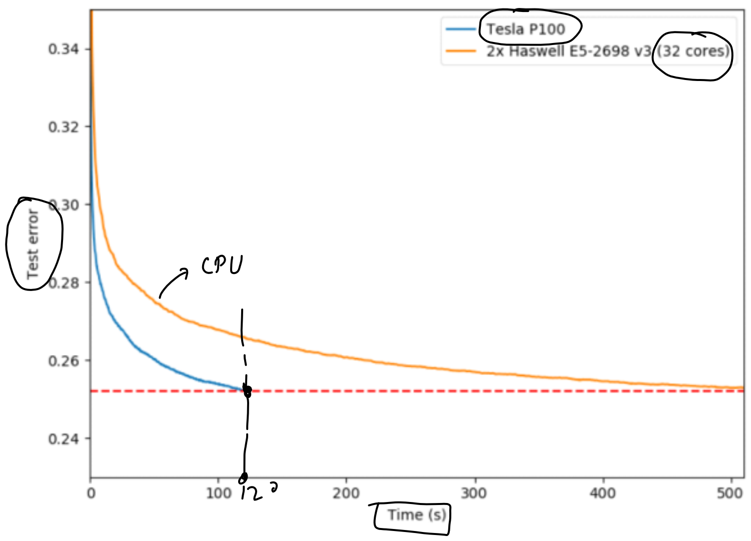


Figure 3. Test error over time for the Higgs dataset, 1000 boosting iterations.

3. Performance →

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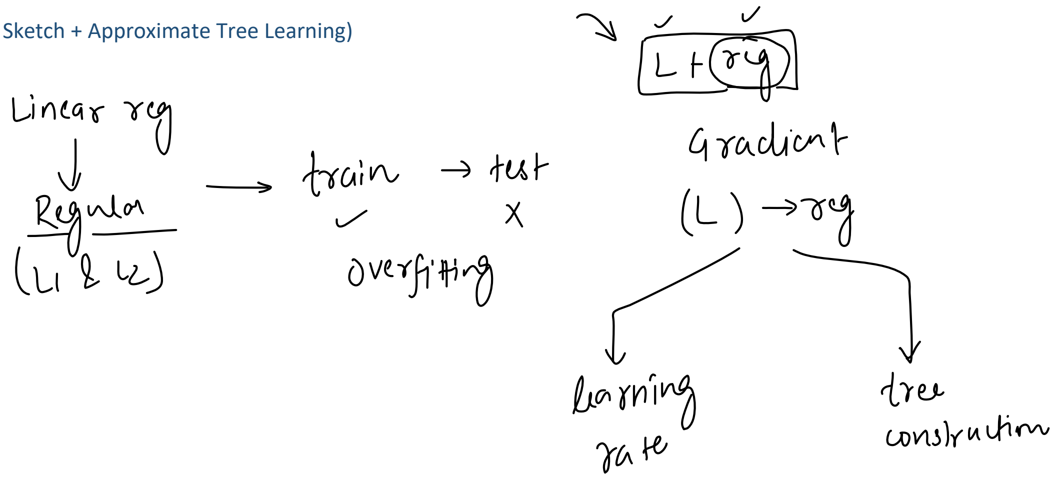
Xgboost

Xgboost → Loss function → min

1. Regularized Learning Objective
2. Handling Missing values
3. Sparsity Aware Split Finding
4. Efficient Split Finding(Weighted Quantile Sketch + Approximate Tree Learning)
5. Tree Pruning



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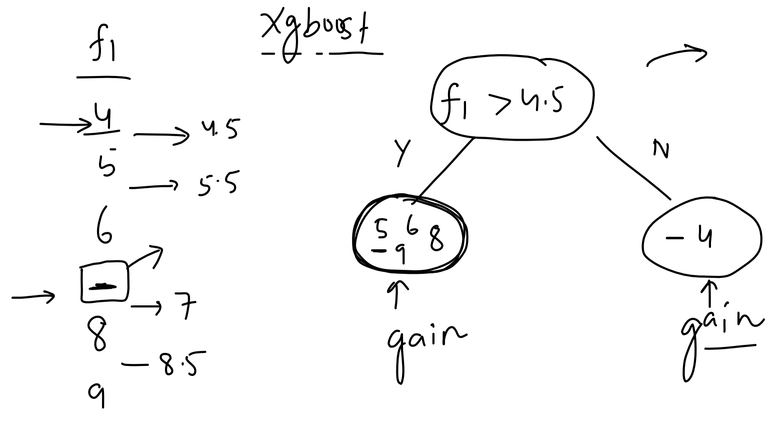
ml → missing
↳ prepro
↳ impute



directional sense

1. Regularized Learning Objective ✓
2. Handling Missing values ✓
3. Sparsity Aware Split Finding ✓
4. Efficient Split Finding(Weighted Quantile Sketch + Approximate Tree Learning)
5. Tree Pruning

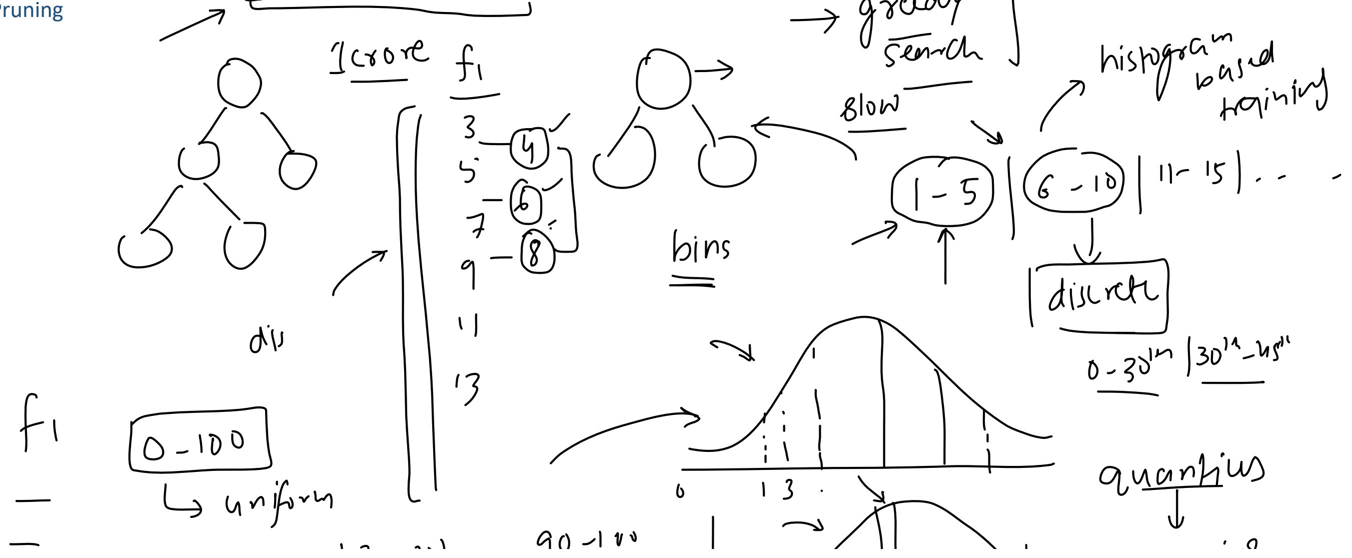
data bins

speed ↑ performance ↓

exact greedy search

slow

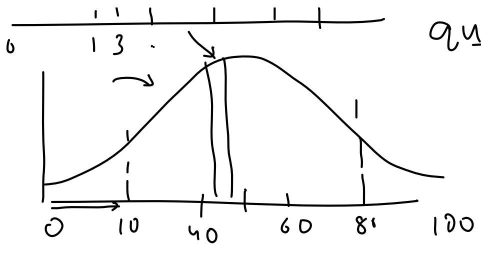
histogram based training



↳ uniform

0-10 | 10-20 | 20-30 | . . 90-100

↳ unif



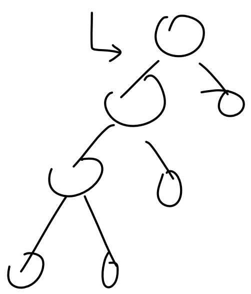
quantiles

↓

binning

GB

1. Regularized Learning Objective ✓
2. Handling Missing values ✓
3. Sparsity Aware Split Finding ✓
4. Efficient Split Finding(Weighted Quantile Sketch + Approximate Tree Learning) ✓
5. Tree Pruning → perform XgBoost



→ reduce complexity

↓

overfitting

→ Post pruning

→ pre pruning

$\boxed{\text{XgBoost}}$

→ prepruning

→ postpr

→ $\boxed{\text{gamma value}}$