Replication Instructions for X264 Configuration Performance Study

Configuration Performance Learning Research

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1 Introduction

This document provides detailed instructions for replicating the experimental results presented in our study comparing Linear Regression and LightGBM models for predicting x264 encoder performance. By following these steps, you should be able to reproduce our findings with minimal deviation.

2 Obtaining the Source Code

The complete source code for this study is available on GitHub:

```
# Clone the repository
git clone https://github.com/niziyan/x264-performance-prediction.git
cd x264-performance-prediction
```

3 Environment Setup

To ensure consistent results, we recommend setting up a virtual environment with the exact versions of dependencies used in our study:

```
# Create and activate a virtual environment
python -m venv x264_env
source x264_env/bin/activate  # On Windows: x264_env\Scripts\activate

# Install dependencies with specific versions
pip install numpy==1.19.5
pip install pandas==1.2.4
pip install scikit-learn==0.24.2
pip install lightgbm==3.2.1
```

4 Dataset Preparation

4.1 Obtaining the Dataset

The x264 dataset (version baee400) used in our study can be downloaded from: https://github.com/ideas-labo/ISE/tree/main/lab2

```
# Download the dataset
git clone https://github.com/ideas-labo/ISE/tree/main/lab2
```

4.2 Dataset Organization

Ensure the dataset is properly organized in the expected directory structure:

```
datasets/
          x264/
              blue_sky_1080p25.csv
              Johnny_1280x720_60.csv
              Netflix_Crosswalk_1080p.csv
              Riverbed_1080p25.csv
              SD_Bridge_close_cif.csv
              SD_City_cif.csv
              SD_Crew_cif.csv
              Pedestrian_1080p25.csv
              Sintel_Trailer_1080p24.csv
```

5 Replicating Experiments

5.1 Creating Required Directories

Ensure the log directory structure exists:

```
mkdir -p log
```

5.2 Running Linear Regression Experiments

To replicate the Linear Regression results:

```
# Run on all CSV files in the x264 dataset with 30 iterations per file
python lr.py --dataset x264 --runs 30
```

5.3 Running LightGBM Experiments

To replicate the LightGBM results:

```
# Run on all CSV files in the x264 dataset with 30 iterations per file
python lightGBM.py --dataset x264 --runs 30
```

These commands will process all nine video datasets, running 30 experiments for each dataset with different random seeds for train-test splitting.

6 Verifying Results

6.1 Expected Outcome

After running the experiments, you should find log files in the log directory. The average results across all nine videos should be approximately:

Table 1: Expected Performance Results

Model	**MAE (s)**	**RMSE (s)**	**MAPE (%)**
Linear Regression	4.32±0.25	6.19±0.35	18.7±1.2
LightGBM	3.12±0.20	4.24±0.28	13.9±0.8

7 Troubleshooting

If you encounter discrepancies in your results, check these common issues:

- **Package Versions**: Different versions of packages, especially scikit-learn and lightgbm, can produce slightly different results. Ensure you use the exact versions specified.
- **Random Seed**: Our experiments use fixed random seeds for reproducibility. Ensure you haven't modified the random state parameters in the code.
- **Hardware Differences**: Numerical precision may vary slightly on different hardware. Results should still be very close.
- **Dataset**: Verify you're using the exact same dataset (x264 version baee400) to ensure consistent results.

8 Extended Experiments

To explore beyond our reported results, you may want to try:

- Different train-test split ratios:

```
# Modify data_loader.py to use different test_size
python lr.py --dataset x264 --runs 10
python lightGBM.py --dataset x264 --runs 10

```

- Different LightGBM hyperparameters:

```
# Modify params in lightGBM.py
python lightGBM.py --dataset x264 --runs 10

```

- Adding more models (e.g., Random Forest, Neural Networks)

9 Conclusion

By following these instructions, you should be able to replicate our experimental results comparing Linear Regression and LightGBM for x264 configuration performance prediction. If successful, you should observe that LightGBM consistently outperforms Linear Regression across all metrics, with statistical significance (p ¡ 0.001).