# User Manual for X264 Configuration Performance Learning Tool

Configuration Performance Learning Research

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## 1 Introduction

This manual explains how to use the X264 Configuration Performance Learning Tool. The tool provides two machine learning models (Linear Regression and LightGBM) to predict the performance of different x264 encoder configurations.

## 2 Installation

Before using the tool, ensure you have installed all required dependencies as specified in the requirements document. The basic installation steps are:

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

# Install dependencies
pip install -r requirements.txt
```

## 3 Dataset Preparation

### 3.1 Dataset Format

The tool expects datasets in CSV format with the following structure:

- Each row represents a specific x264 configuration
- Each column represents a configuration parameter
- The last column contains the performance metric (runtime in seconds)

### 3.2 Dataset Organization

Place your dataset files in the correct directory structure:

```
datasets/
          x264/
              blue_sky_1080p25.csv
              Johnny_1280x720_60.csv
              ... (other video datasets)
```

## 4 Tool Components

The tool consists of three main Python scripts:

### 4.1 data_loader.py

This script handles dataset loading and preparation. It provides the following functionality:

- Listing available datasets in the datasets directory
- Loading specific datasets and splitting them into training and test sets

You can use this script directly to check available datasets:

```
python data_loader.py
```

### 4.2 lr.py

This script implements the Linear Regression model for predicting x264 performance. It includes functions for:

- Training the linear regression model
- Evaluating model performance using multiple metrics
- Running multiple experiments with different random seeds
- Logging results to files

### 4.3 lightGBM.py

This script implements the LightGBM gradient boosting model for predicting x264 performance. It offers:

- Training a gradient boosting model with tuned parameters
- Evaluating model performance using multiple metrics
- Running multiple experiments with different random seeds
- Logging results to files

## 5 Usage Instructions

### 5.1 Listing Available Datasets

To view all available datasets:

```
python data_loader.py
```

### 5.2 Running Linear Regression Model

To train and evaluate the Linear Regression model:

```
# Run on all CSV files in the x264 dataset
python lr.py --dataset x264

# Run on a specific CSV file
python lr.py --dataset x264 --csv blue_sky_1080p25.csv

# Change the number of experimental runs
python lr.py --dataset x264 --runs 10
```

### 5.3 Running LightGBM Model

To train and evaluate the LightGBM model:

```
# Run on all CSV files in the x264 dataset
python lightGBM.py --dataset x264

# Run on a specific CSV file
python lightGBM.py --dataset x264 --csv blue_sky_1080p25.csv

# Change the number of experimental runs
python lightGBM.py --dataset x264 --runs 10
```

### 5.4 Command-line Arguments

Both model scripts accept the following command-line arguments:

Table 1: Command-line Arguments

| Argument | Default | Description |
|---|---|---|
| –dataset | x264 | Dataset directory name |
| –csv | None | Specific CSV file (if None, processes all) |
| –runs | 30 | Number of experimental runs |

## 6 Understanding the Results

### 6.1 Performance Metrics

The tool reports three key performance metrics:

- MAE (Mean Absolute Error): Average magnitude of errors in seconds
- RMSE (Root Mean Squared Error): Square root of average squared errors
- MAPE (Mean Absolute Percentage Error): Percentage of error relative to actual value

### 6.2 Result Logs

Results are saved to log files with the following naming convention:

```
log/YYYYMMDD/model-name/model_dataset_csvfile_timestamp.txt
```

Each log file contains:

- Dataset name
- Number of runs
- Performance metrics with mean and standard deviation

Example log file content:

```
dataset: blue_sky_1080p25.csv
runs: 30
MAE: 3.12 0 .21
RMSE: 4.24 0 .32
MAPE: 13.90 0 .75
```

# 7 Troubleshooting

## 7.1 Dataset Not Found

If you receive a ”Dataset not found” error:

- Check that your dataset files are in the correct directory
- Ensure file names match exactly what you specified
- Verify file permissions allow reading

## 7.2 Model Training Errors

If you encounter errors during model training:

- Verify dataset format has features in all columns except the last
- Check for missing or non-numeric values in your dataset
- Ensure sufficient memory for the dataset size

# 8 Contact Information

For further assistance or to report issues, please contact:

- Project repository: `https://github.com/niziyan/x264-performance-prediction`