

# Labwork 2: Linear Regression

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## 1 Introduction

Linear regression is a method used to find the relationship between a variable  $y$  and variables  $x$ . It assumes a linear relationship, often represented as:

$$y = w_1x + w_0$$

$w_1$  is the slope of the line and  $w_0$  is the intercept.

The goal of linear regression is to find the best-fitting line that minimizes the MSE of our model. We use GradientDescent2D for that.

## 2 Linear Regression Implementation

- `load_csv(file_path)`: Loads CSV data from `file_path`.
- `L(X, y, w1, w0)`: Calculates mean squared error loss.
- `deri_w1(X, y, w1, w0)`: Computes gradient of loss w.r.t.  $w_1$  parameter.
- `deri_w0(X, y, w1, w0)`: Computes gradient of loss w.r.t.  $w_0$  parameter.
- `print_step(time, w1, w0, loss)`: Prints iteration step, parameter values, and loss.
- `GradientDescent2D(X, y, w1, w0, L, deri_w1, deri_w0, lr, stop)`: Performs gradient descent to optimize parameters.
- `LinearRegression(X, y)`: linear regression process, initializes parameters, and prints final regression equation.

## 3 Different learning rate L

we use

- $X$ : [1.0, 2.0, 3.0, 4.0, 5.0]
- $y$ : [3.0, 5.0, 7.0, 9.0, 11.0]

- $w1 = 1$
- $w0 = 0$
- $\text{stop} = 0.000001$

## 4 Conclusion