

M9-L1 Problem 1

Here, you will implement three loss functions from scratch in numpy: MAE, MSE, and MAPE.

```
In [1]: import numpy as np

y_gt1 = np.array([1,2,3,4,5,6,7,8,9,10])
y_pred1 = np.array([1,1.3,3.1,4.6,5.9,5.9,6.4,9.2,8.1,10.5])

y_gt2 = np.array([-3.23594765, -3.74125693, -2.3040903, 0., 0.30190142,
y_pred2 = np.array([-3.17886560e+00, -3.72628642e+00, -2.28154027e+00, -2.42424242e
```

Mean Absolute Error

Complete the definition for `MAE(y_gt, y_pred)` below.

$$\text{MAE} = \frac{1}{n} \sum_{i=1}^n |y_i - \hat{y}_i| = \frac{1}{n} \sum_{i=1}^n |e_i|$$

`MAE(y_gt1, y_pred1)` should return 0.560.

```
In [3]: def MAE(y_gt, y_pred):
        # YOUR CODE GOES HERE
        return np.sum(np.abs(y_gt-y_pred))/len(y_pred)

print(f"MAE(y_gt1, y_pred1) = {MAE(y_gt1, y_pred1):.3f}")
print(f"MAE(y_gt2, y_pred2) = {MAE(y_gt2, y_pred2):.3f}")
```

MAE(y_gt1, y_pred1) = 0.560

MAE(y_gt2, y_pred2) = 0.290

Mean Squared Error

Complete the definition for `MSE(y_gt, y_pred)` below.

$$\text{MSE} = \frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2 = \frac{1}{n} \sum_{i=1}^n (e_i)^2 = \frac{1}{n} e^T e$$

`MSE(y_gt1, y_pred1)` should return 0.454.

```
In [4]: def MSE(y_gt, y_pred):
        # YOUR CODE GOES HERE
        return np.sum((y_gt-y_pred)**2)/len(y_pred)
```

```
print(f"MSE(y_gt1, y_pred1) = {MSE(y_gt1, y_pred1):.3f}")
print(f"MSE(y_gt2, y_pred2) = {MSE(y_gt2, y_pred2):.3f}")
```

```
MSE(y_gt1, y_pred1) = 0.454
```

```
MSE(y_gt2, y_pred2) = 0.174
```

Mean Absolute Percentage Error

Complete the definition for `MAPE(y_gt, y_pred, epsilon)` below.

$$\text{MAE} = \frac{1}{n} \sum_{i=1}^n \frac{|y_i - \hat{y}_i|}{|y_i| + \varepsilon} = \frac{1}{n} \sum_{i=1}^n \frac{|e_i|}{|y_i| + \varepsilon}$$

`MAPE(y_gt1, y_pred1, 1e-6)` should return 0.112.

```
In [6]: def MAPE(y_gt, y_pred, epsilon=1e-6):
        # YOUR CODE GOES HERE
        return np.sum(np.abs((y_gt-y_pred))/(np.abs(y_gt)+epsilon)) / len(y_pred)

print(f"MAPE(y_gt1, y_pred1) = {MAPE(y_gt1, y_pred1):.3f}")
print(f"MAPE(y_gt2, y_pred2) = {MAPE(y_gt2, y_pred2):.3f}")
```

```
MAPE(y_gt1, y_pred1) = 0.112
```

```
MAPE(y_gt2, y_pred2) = 0.032
```

```
In [ ]:
```