

# Introduction to Machine Learning

## Lab 1: Grip Force Prediction using Regression

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### 1. Regression Equation in Basic Part

$$gripForce_i = w_0 + w_1 weight_i + w_2 weight_i^2 + w_3 weight_i^3 + w_4 weight_i^4 + w_5 weight_i^5 + w_6 weight_i^6 + w_7 weight_i^7$$

### 2. Variables and Regression Equation in Advanced Part

In the basic part, the model takes only one type of attribute (weight) as input, whereas in the advanced part, the model receives seven different types of attributes as input.

$gripForce_i$

$$= \begin{cases} \sum_{p=1}^4 w_{m,0,p} age_i^p + \sum_{p=1}^2 w_{m,2,p} height_i^p + \sum_{p=1}^2 w_{m,3,p} weight_i^p + \sum_{p=1}^2 w_{m,4,p} bodyFat_i^p + w_{m,5,1} diastolic_i^1 + w_{m,6,1} systolic_i^1 + w_{m,constant}, & \text{gender}_i \text{ is male} \\ \sum_{p=1}^4 w_{f,0,p} age_i^p + \sum_{p=1}^2 w_{f,2,p} height_i^p + \sum_{p=1}^2 w_{f,3,p} weight_i^p + \sum_{p=1}^2 w_{f,4,p} bodyFat_i^p + w_{f,5,1} diastolic_i^1 + w_{f,6,1} systolic_i^1 + w_{f,constant}, & \text{gender}_i \text{ is female} \end{cases}$$

- $w_{gj,p}$ :

It is a coefficient.  $g$  means gender.  $j$  means attribute.  $p$  means power.

For example,  $w_{m,0,1}$  is the coefficient of  $age_i^1$  while  $gender_i$  is male.

- **Attributes enumeration:**

{  $age: 0, gender: 1, height: 2, weight: 3, bodyFat: 4, diastolic: 5, systolic: 6$  }

### 3. Difficulty

I wasn't familiar with the modules imported in this lab, so I spent a lot of time debugging data type mismatches. Additionally, I lacked experience with matrix operations in Python, which also took me a significant amount of time to resolve. Furthermore, I'm not sure how to estimate which degree might provide a good solution; the only approach I could take was to test each case one by one.

### 4. How I Solve the Difficulty and My Reflections

There is no other way to solve my problems except by reading Python documentation and some tutorial articles on the internet. Overall, the hints in the template are sufficient for me to complete this lab. However, if there were some guidelines on data analysis, it would be easier for me to think about how to design the model rather than relying on guesswork.