

Lecture Notes

**Title to decide. Technical notes for
Physics**

Dedica

Contents

1	Introduction	4
1.1	How to write code text in LaTeX	4
2	Plotly	6
2.1	Boxplots	6
3	Statistical methods	7
3.1	Linear regression	7
3.2	Logistic Regression	7
3.3	Classification	7
3.4	Principal Component analysis	7
3.5	Statistical test	7
3.5.1	ANOVA	7
3.5.2	chi double	7

Chapter 1

Introduction

In this work Niccolò and Cecilia want to create lecture notes on the language program Python¹ with a deep focus on Pytorch² and TensorFlow³. Sections designated to plots and basics statistical methods will also be provided...

1.1 How to write code text in LaTeX

If you want to write codes from a .py in a specific box, you need to use the following command: `\lstinputlisting[language=Octave]example_code.py`

```
1 # -*- coding: utf-8 -*-
2 import numpy as np
3 import math
4
5 # Create random input and output data
6 x = np.linspace(-math.pi, math.pi, 2000)
7 y = np.sin(x)
8
9 # Randomly initialize weights
10 a = np.random.randn()
11 b = np.random.randn()
12 c = np.random.randn()
13 d = np.random.randn()
14
15 learning_rate = 1e-6
16 for t in range(2000):
17     # Forward pass: compute predicted y
18     # y = a + b x + c x^2 + d x^3
19     y_pred = a + b * x + c * x ** 2 + d * x ** 3
20
21     # Compute and print loss
```

¹Python

²Pythorch documentation

³TensorFlow documentation

```
22     loss = np.square(y_pred - y).sum()
23     if t % 100 == 99:
24         print(t, loss)
25
26     # Backprop to compute gradients of a, b, c, d with respect to loss
27     grad_y_pred = 2.0 * (y_pred - y)
28     grad_a = grad_y_pred.sum()
29     grad_b = (grad_y_pred * x).sum()
30     grad_c = (grad_y_pred * x ** 2).sum()
31     grad_d = (grad_y_pred * x ** 3).sum()
32
33     # Update weights
34     a -= learning_rate * grad_a
35     b -= learning_rate * grad_b
36     c -= learning_rate * grad_c
37     d -= learning_rate * grad_d
38
39     print(f'Result: y = {a} + {b} x + {c} x^2 + {d} x^3')
```

Chapter 2

Plotly

2.1 Boxplots

Boxplots

```
1 import plotly.express as px
2 import plotly.graph_objects as go
3
4 df = pd.read_excel(input)
5 fig_asd = px.box(df, y=['ASD [mm]'], points="all")
6 fig.add_trace(go.Box(fig_asd['data'][0], marker_color='darkblue',
7     boxmean=True))
8 fig.update_layout(title='', showlegend=False, boxgap=0.1, boxgroupgap
9     =0.5, font=dict(size=25))
10 fig.write_html(os.path.join(output_path_folder, 'bb_metric.html'))
11 # to run this Kaleido need to be installed in a environment path without
12 # any accent
13 fig.write_image(os.path.join(output_path_folder, 'bb_metric.png'))
14 fig.show()
```

Listing 2.1: Python example

Chapter 3

Statistical methods

3.1 Linear regression

3.2 Logistic Regression

3.3 Classification

3.4 Principal Component analysis

3.5 Statistical test

3.5.1 ANOVA

3.5.2 chi double