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Standard Normal Distribution - Lab

Introduction

In the previous lesson, we looked at the formula and a few toy examples to explain an observation's standard score and data standardization for normally distributed data. This lab, will shall standardize and visualize some normal distributions before we see standardization's real impact in machine learning in upcoming lessons.

Objectives

You will be able to:

- Calculate and interpret z-scores for observations
- Visualize the data before-after standardization to visually inspect the results.

Let's get started

> A Z-score tells us “how many standard deviations above or below the mean.” Every time you obtain a Z-score, use “above” or “below” in your phrasing.

The yields of apples trees in an orchard has been recorded in the file `yield.csv`. Each observation is recorded by weighing apples from trees (in pounds) and adding their weights. There are 5000 observations in total for this data.

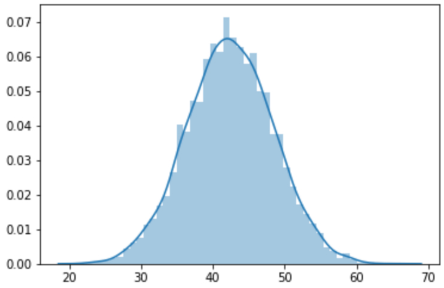
1. Load, visualize and give general comments on the dataset. Use pandas for loading and inspecting the data.

In [34]:

```
# Import libraries
import numpy as np
import seaborn as sns
import pandas as pd

# Read the yield data as a dataframe
df = pd.read_csv('yield.csv')
df.head()
sns.distplot(df)
```

Out[34]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1951e0f0>
```



In [35]:

```
# Your comments about the data here.

# The data is normally distributed as shown by the density curve.
```

2. Write a simple sentence to explain what does each value represent in this data?

In [ ]:

```
# Your answer here

# Each value represents the a yield from a single tree in terms of total weight of apples
# that were obtained from this tree.
```

3. What does the 3-sigma rule say about yields of trees ?

In [26]:

```
# Perform any calculations necessary here
mean = df.mean()
sd = df.std()
mean,sd
```

Out[26]:

```
(0    42.407624
 dtype: float64, 0    6.003697
 dtype: float64)
```

In [23]:

```
# Write your answer here

# mean value is 42.4 and standard deviation is 6 (rounded off)
# 68% of tree yields have weight between (42.4 - 6) 36.4 and (42.4 - 6) 48.4 pounds;
# 95% between 30.4 and 54.4;
# Almost all between 24.4 and 60.4 pounds
```

4. Compute the Z-score for a tree yielding 35 pounds of apples. Interpret this Z-score.

In [37]:
```
# Calculate z
z = (35 - mean)/sd
z
```

Out[37]:
```
0   -1.233844
dtype: float64
```

In [38]:
```
# Interpret the result

# This tree’s yield is 1.23 standard deviations below the mean yield.
```

5. Suppose a tree has a Z-score of 1.85. Interpret this Z-score. What is the yield of this tree?

In [39]:
```
# Interpret the z score

# This tree’s yield is 1.85 standard deviations above the mean
```

In [42]:
```
X = mean + 1.85*sd
X
```

Out[42]:
```
0    53.514462
dtype: float64
```

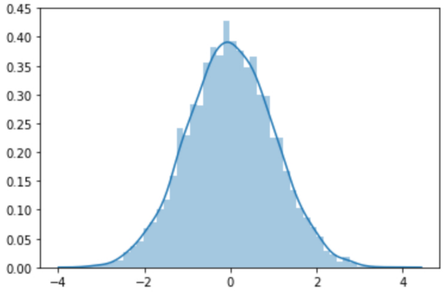
In [ ]:
```
# What is the yield ?

# Yield of this tree is 53.5 pounds.
```

6. Convert each tree’s yield is converted to a Z-score so that “new” derived variable is “Z-score for weight”. The units are still the apple trees. For the data set of all Z-scores:

- What is the shape?
- The mean?
- The standard deviation?

In [56]:
```
z_data = [(x - df['0'].mean())/df['0'].std() for x in df['0']]
sns.distplot(z_data)
mean = np.mean(np.array(z_data))
sd = np.std((np.array(z_data)))
print ('Mean:', round(mean,2))
print ('SD:', round(sd,2))
```

```
Mean: 0.0
SD: 1.0
```



In [ ]:
```
# Your observations
# It is a standard nornal distribution
# Mean is 0 (it is a very small figure that rounds off to 0)
# SD is 1
# This is obvious because we standardised the whole distribution.,
```

Summary

In this lab, you practiced your knowledge on the standard normal distribution!