Project 1 Report

CMSC 409 - Artificial Intelligence

Steven Hernandez

Fully generated data can be found in ‘./Project1_data/data.txt

Scenerio 1: **using only height.**

	Weights
x	1.0
bias	5.6

Assuming the following

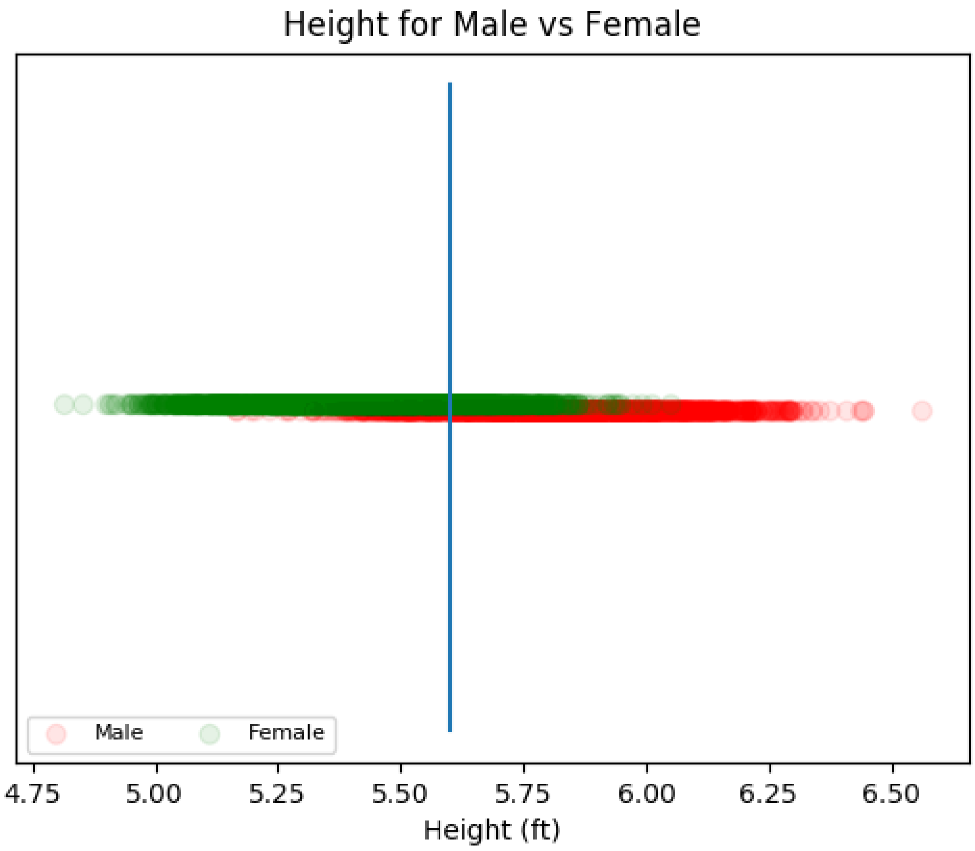
$$net = \sum_{i=1}^{n} w_i x_i \qquad out = \begin{cases} 1 & if\ net \geq 0 \\ 0 & if\ net < 0 \end{cases}$$

Or in this situation:

1 if 0 <= -a(Height) + bias, otherwise 0

where *a* is some weight and *1* is male and *0* is female.

In this situation a=1.0 and bias=5.6



	Predicted Male	Predicted Female
Actual Male	1774	226
Actual Female	371	1629

Confusion Matrix

Error	0.14925
Accuracy	0.85075
True Positive Rate	0.887
True Negative Rate	0.8145
False Positive Rate	0.1855
False Negative Rate	0.113

***Scenerio 2:* heights and weights.**

	Weights
x	-290
y	1
bias	1860

Assuming the following

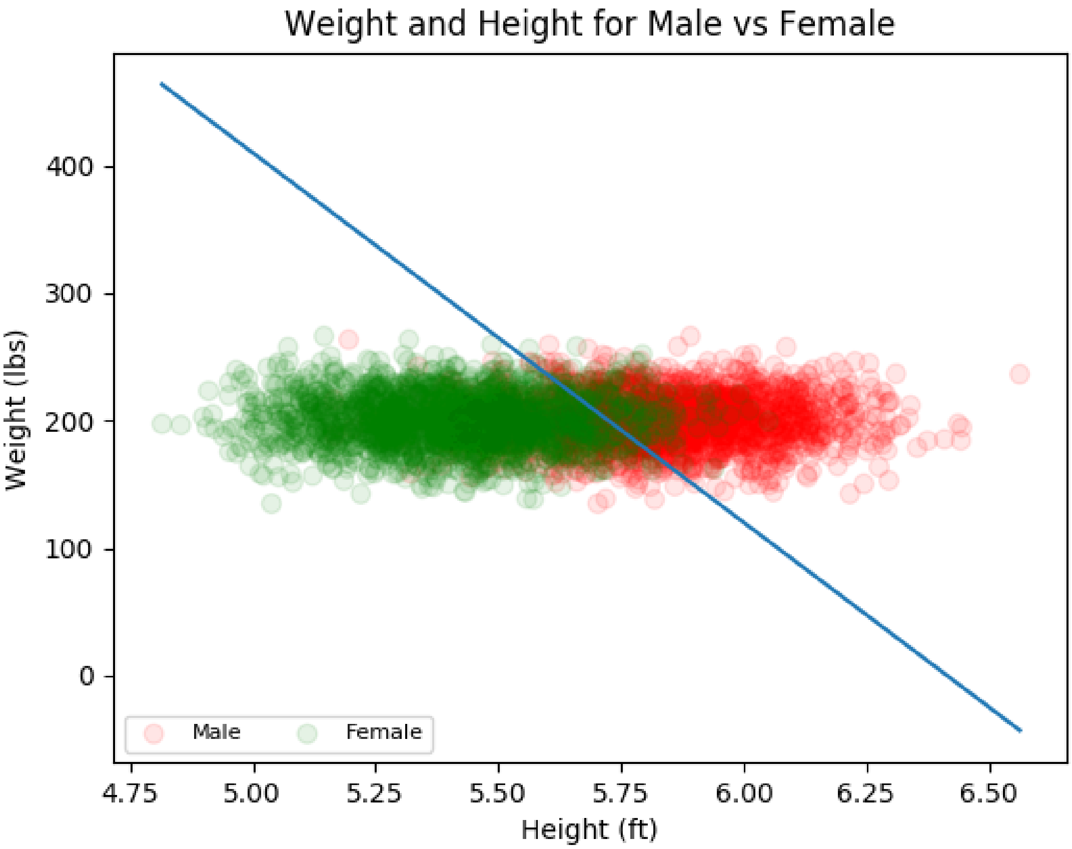
$$net = \sum_{i=1}^{n} w_i x_i \qquad out = \begin{cases} 1 & if\ net \geq 0 \\ 0 & if\ net < 0 \end{cases}$$

Or in this situation:

1 if 0 <= a(Height) - b(Weight) + bias, otherwise 0

where *a* and *b* are some weights and *1* is male and *0* is female.

In this situation a=-290 and b=1 and bias=1860



Notice, Male and Female are on slightly different levels in this graphso that one does not completely cover up the other.

Confusion Matrix

	Predicted Male	Predicted Female
Actual Male	1420	580
Actual Female	37	1963

Error	0.15425
Accuracy	0.84575
True Positive Rate	0.71

True Negative Rate	0.9815
False Positive Rate	0.0185
False Negative Rate	0.29

Libraries Used

matplotlib, numpy, pandas, pandoc

Selected Code Functions

Functions used to generate this data and calculations.

The full code can be found in `./project1.py`

```
def generate_random_data():
    data_file = open(dataFileName, "w")

    for gender in range(0, 2):
        height_mean = 70 / 12 if gender == 0 else 65 / 12
        weight_mean = 200 if gender == 0 else 165

        for i in range(0, 2000):
            # generate random heights and weights in a `normalized` way
            height = np.random.normal(height_mean, 0.2)
            weight = np.random.normal(weight_mean, 20)

            data_file.write(str(height) + "," + str(weight) + "," + str(gender) + "\n")

    data_file.close()


def plot_male_and_females(data_frame, remove_y_axis=False):
    males, females = separate_males_and_females(data_frame)

    male_x = males[0]
    male_y = np.full(males[0].shape, -0.001) if remove_y_axis else males[1]

    female_x = females[0]
    female_y = np.full(males[0].shape, 0.001) if remove_y_axis else males[1]

    male_plot = plt.scatter(male_x, male_y, s=area, c=np.full(males[2].shape, 'r'), alpha=alpha)
    female_plot = plt.scatter(female_x, female_y, s=area, c=np.full(females[2].shape, 'g'), alpha=alpha)

    plt.legend((male_plot, female_plot),
               ('Male', 'Female'),
               scatterpoints=1,
               loc='lower left',
               ncol=3,
               fontsize=8)

    if remove_y_axis:
        plt.title("Height for Male vs Female")
        plt.xlabel("Height (ft)")
    else:
        plt.title("Weight and Height for Male vs Female")
        plt.xlabel("Height (ft)")
        plt.ylabel("Weight (lbs)")


def plot_male_and_females(data_frame, remove_y_axis=False):
    males, females = separate_males_and_females(data_frame)

    male_x = males[0]
    male_y = np.full(males[0].shape, -0.001) if remove_y_axis else males[1]

    female_x = females[0]
    female_y = np.full(males[0].shape, 0.001) if remove_y_axis else males[1]

    male_plot = plt.scatter(male_x, male_y, s=area, c=np.full(males[2].shape, 'r'), alpha=alpha)
    female_plot = plt.scatter(female_x, female_y, s=area, c=np.full(females[2].shape, 'g'), alpha=alpha)

    plt.legend((male_plot, female_plot),
               ('Male', 'Female'),
               scatterpoints=1,
               loc='lower left',
               ncol=3,
               fontsize=8)

    if remove_y_axis:
        plt.title("Height for Male vs Female")
        plt.xlabel("Height (ft)")
    else:
        plt.title("Weight and Height for Male vs Female")
        plt.xlabel("Height (ft)")
        plt.ylabel("Weight (lbs)")


def get_confusion_matrix(data_frame, sep_line):
    true_positive = 0
    true_negative = 0
    false_positive = 0
    false_negative = 0

    for row in data_frame.iterrows():
        r = row[1]

        if len(sep_line[0]) == 3:
            height = r[0]
            weight = r[1]
            gender = r[2]
            x_weight = sep_line[0][0]
            y_weight = sep_line[0][1]
            bias = sep_line[0][2]

            # 0 <= bx + x - ay
            if (x_weight * height) + bias - (y_weight * weight) >= 0:
                if gender == 1:
                    true_positive += 1
                else:
                    false_positive += 1
            else:
                if gender == 0:
                    true_negative += 1
                else:
                    false_negative += 1
        else:
            height = r[0]
            weight = r[1]
            gender = r[2]
            x_weight = sep_line[0][0]
            bias = sep_line[0][1]

            # 0 <= bx - c
            net = x_weight * height - bias * 1

            if net < 0:
                if gender == 1:
                    true_positive += 1
                else:
                    false_positive += 1
            else:
                if gender == 0:
                    true_negative += 1
                else:
                    false_negative += 1

    return (true_positive,
            true_negative,
            false_positive,
            false_negative)
```