Logistic Regression

Logistic Regression

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Logistic Regression

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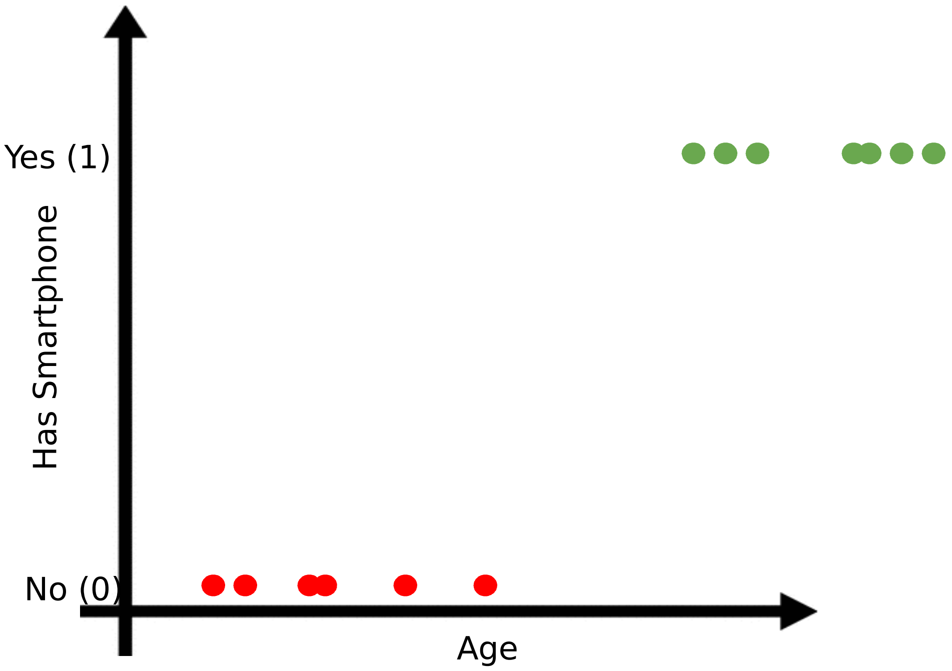
Logistic Regression



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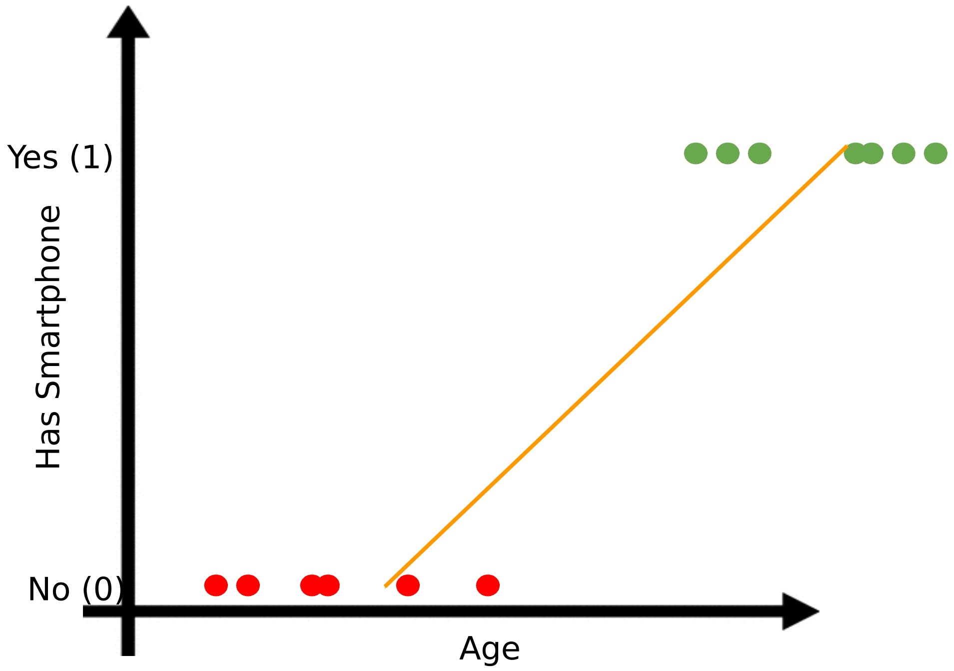
Logistic Regression



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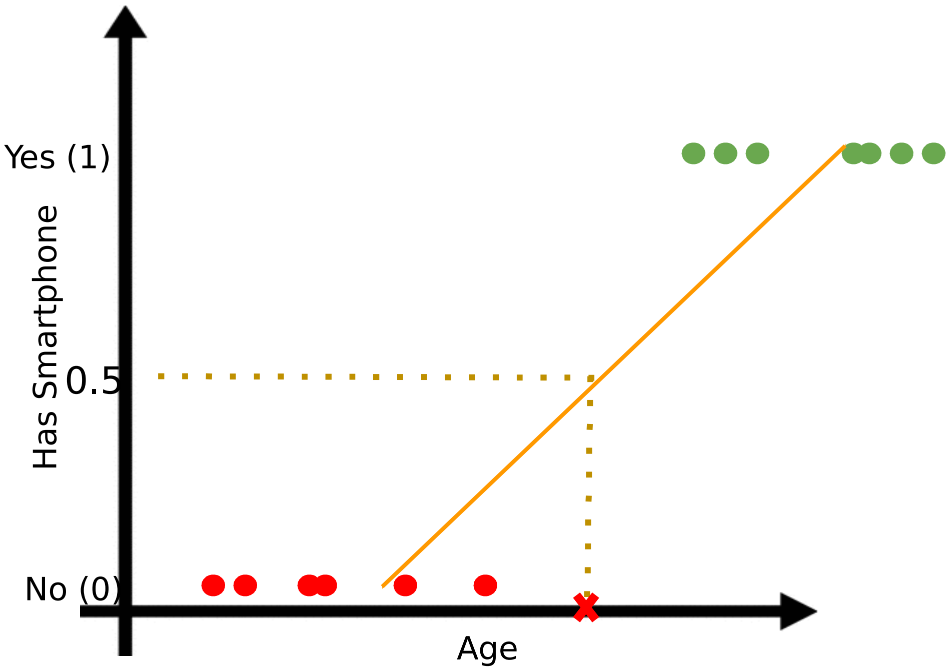
Logistic Regression



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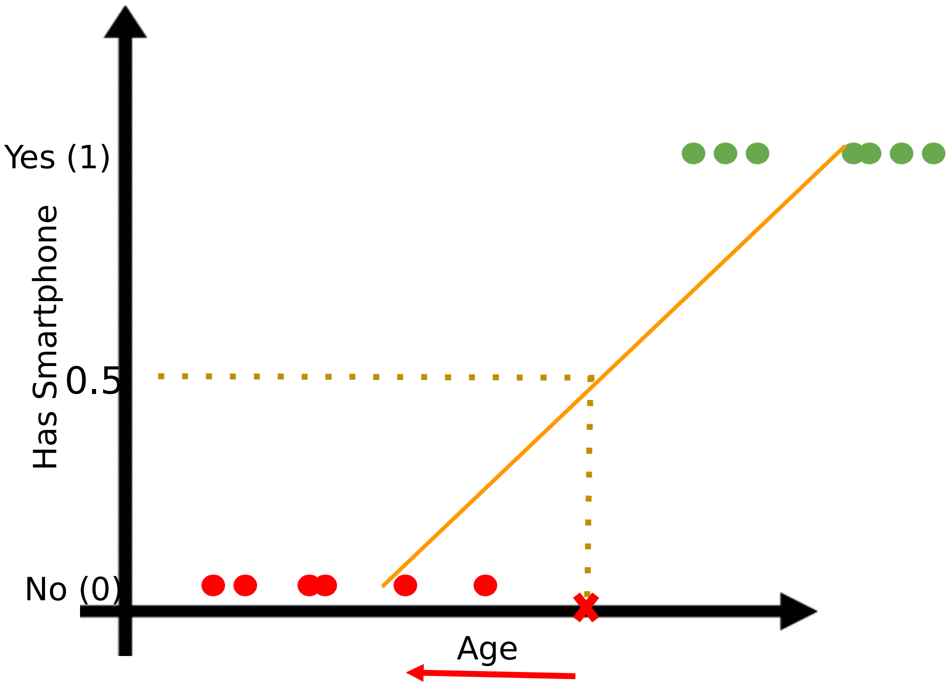

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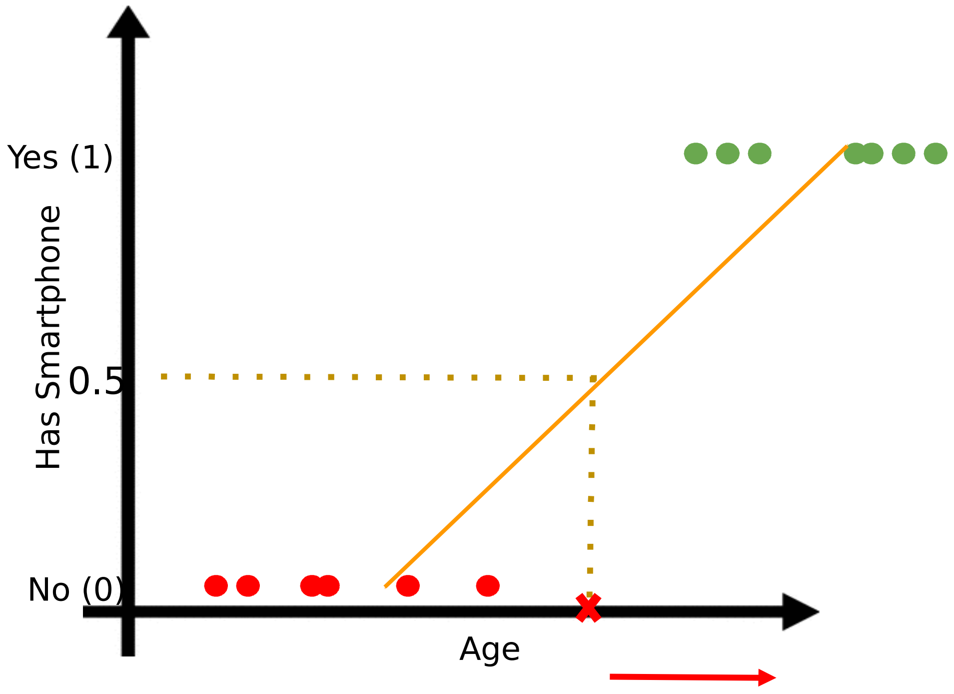
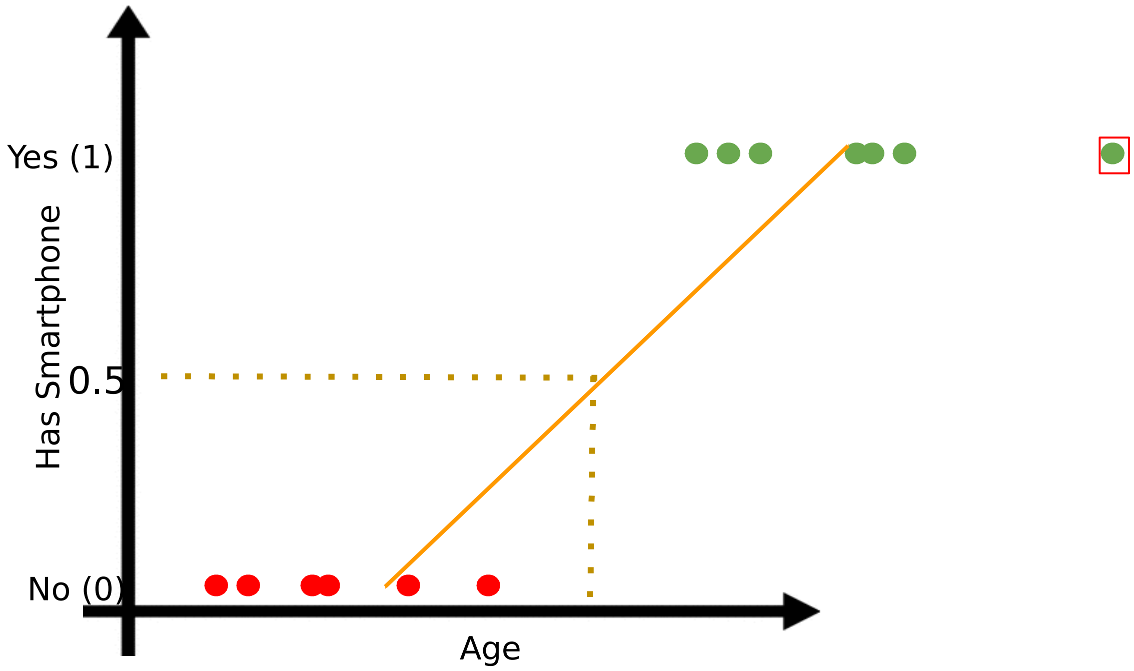
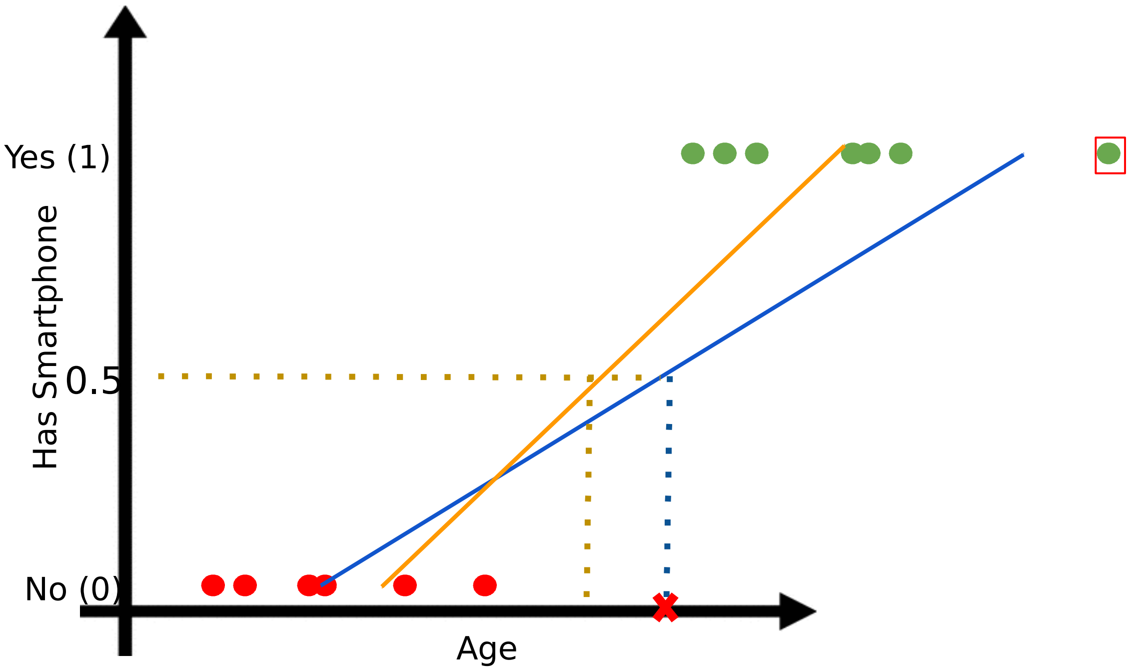


Logistic Regression



Logistic Regression



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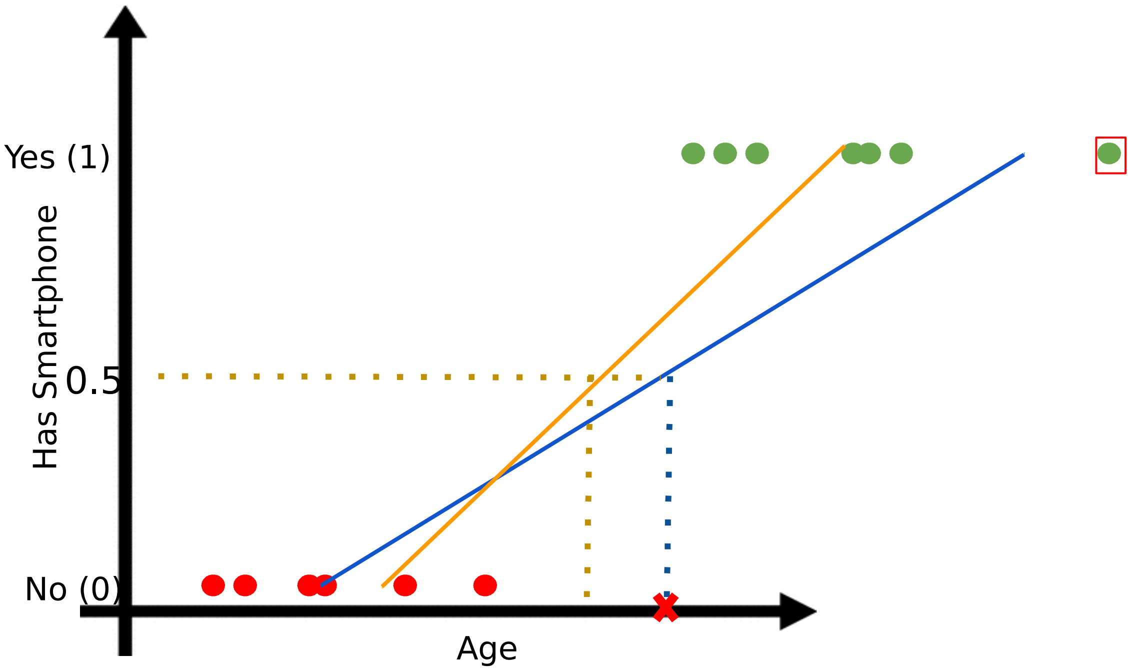
Logistic Regression

- Any new point changes the model line



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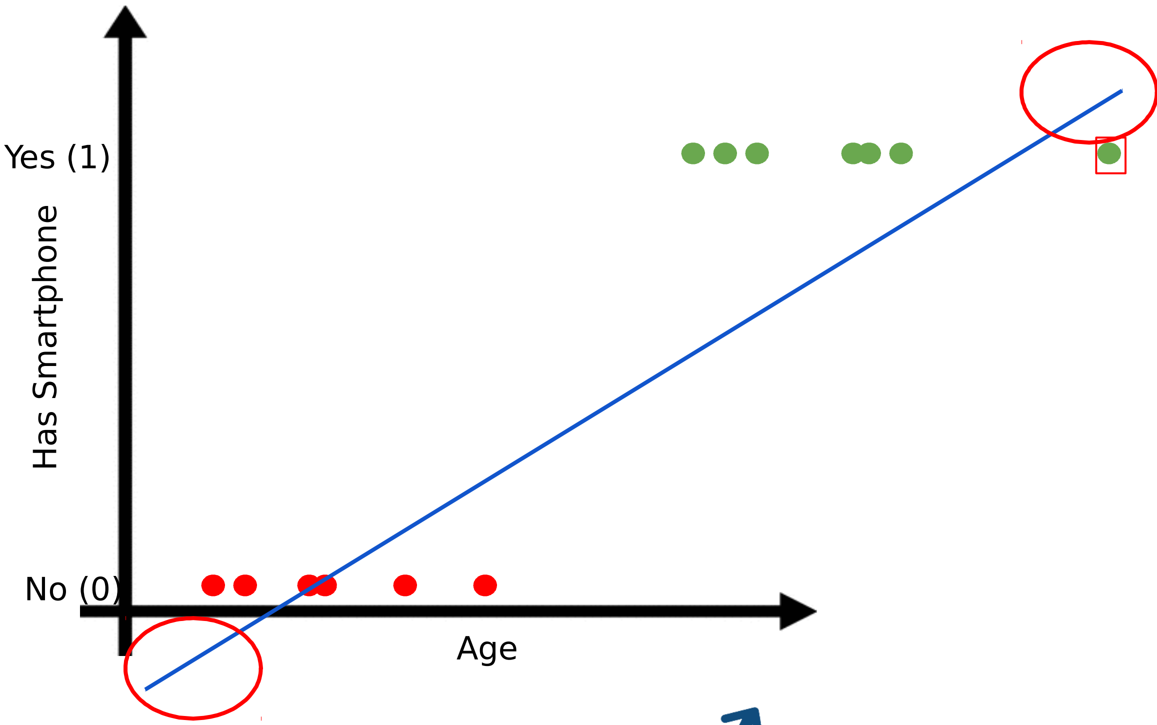
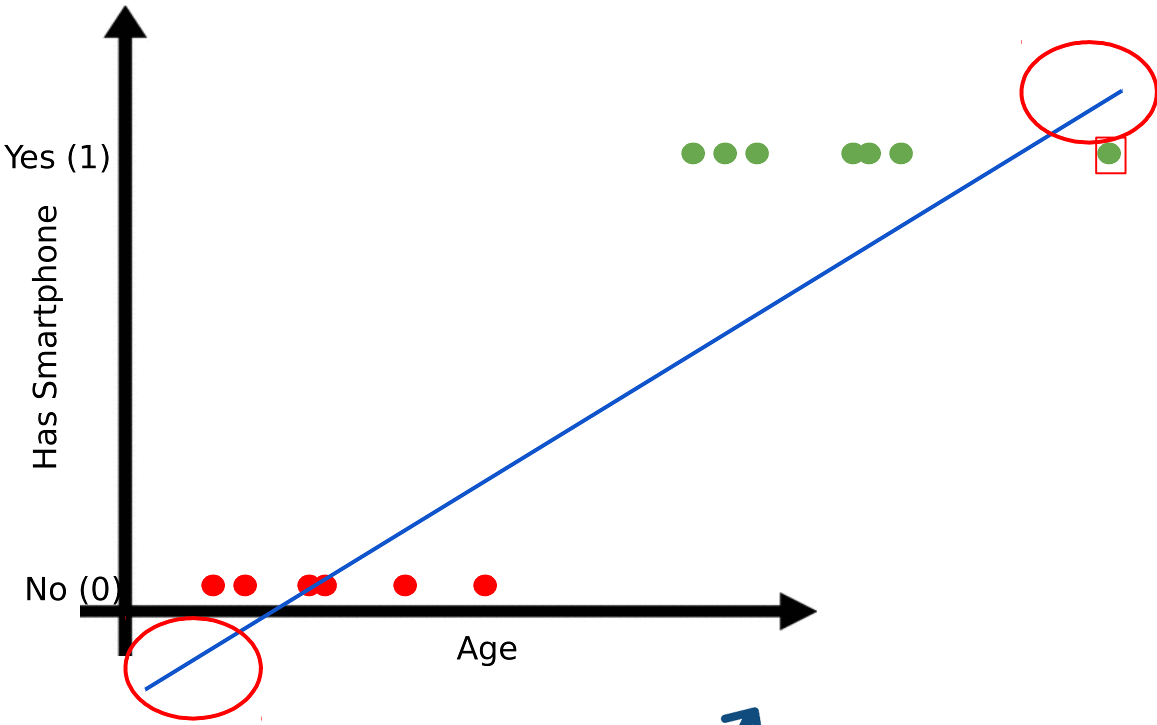
Logistic Regression

- Any new point changes the model line
- The result may be greater than 1 or less than 0



Logistic Regression

- Any new point changes the model line
- The result may be greater than 1 or less than 0
- Makes model interpretation a challenge



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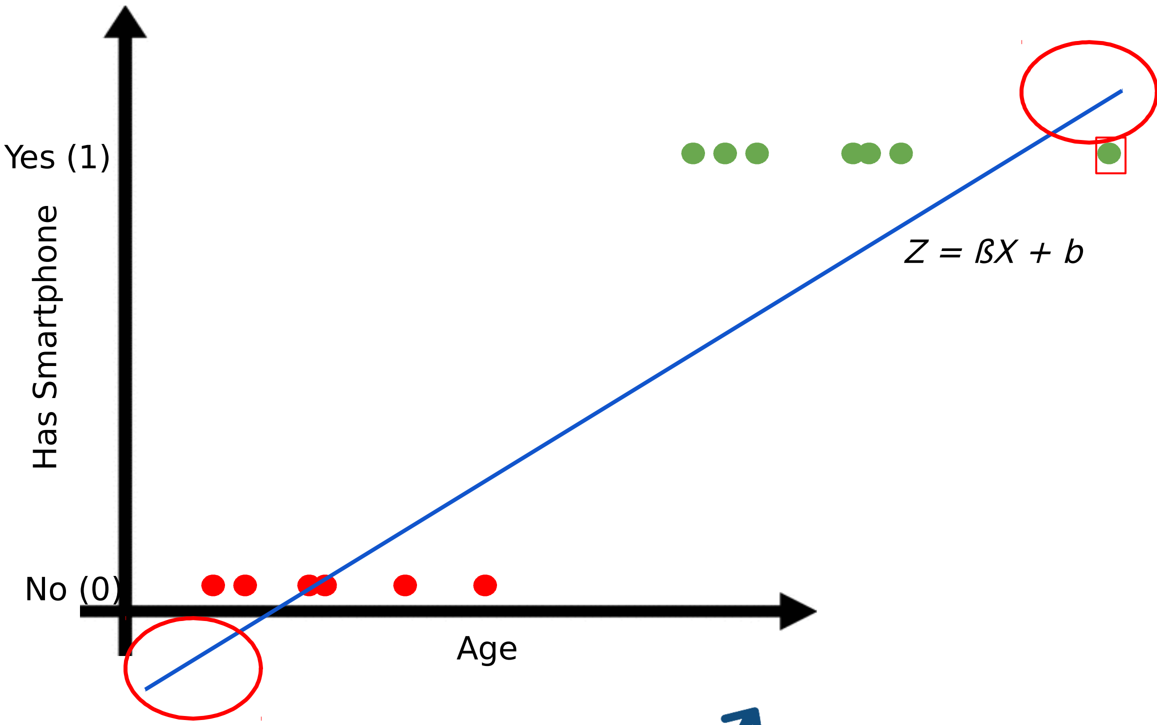
Logistic Regression

$Z = ßX + b$



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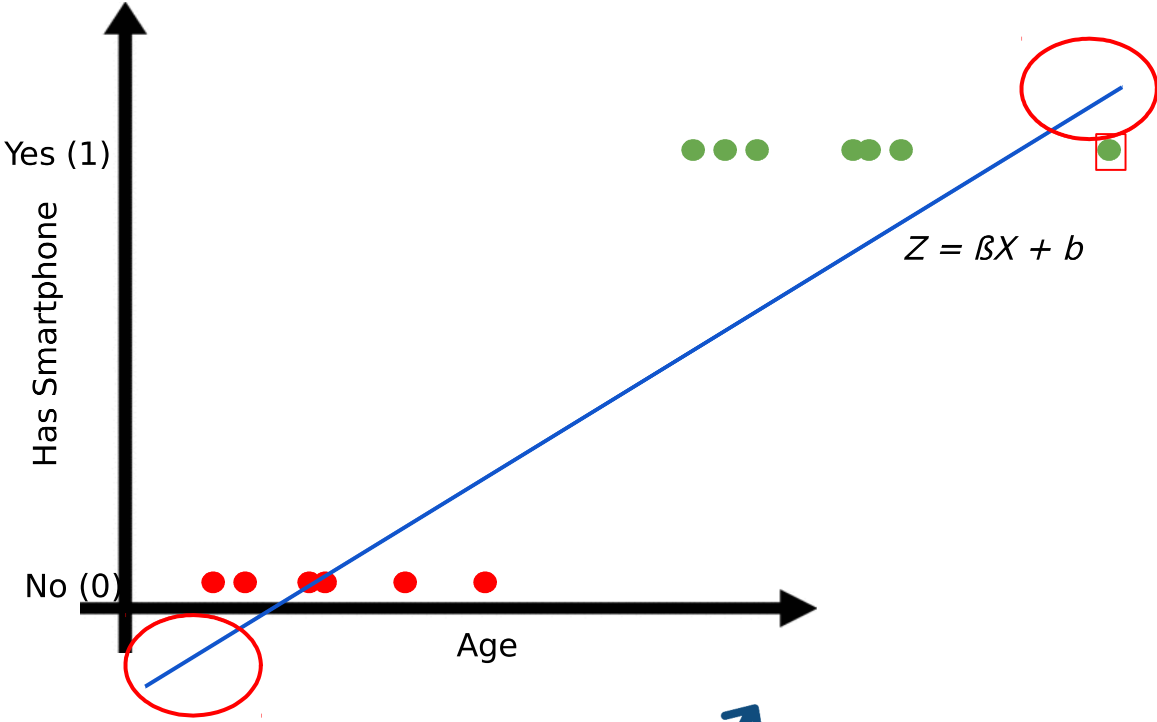
Logistic Regression

$Z = ßX + b$

$\hat{Y} = Q(Z)$

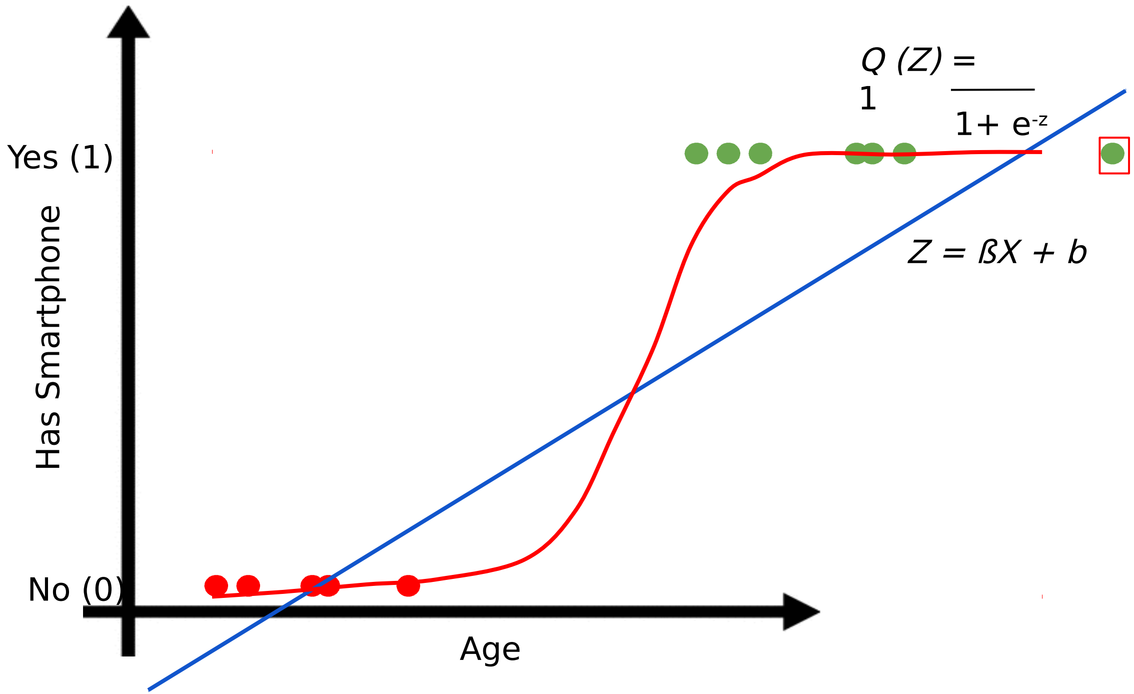


Logistic Regression

$$Z = \beta X + b$$

$$Y = Q(Z)$$

$$Q(Z) = \frac{1}{1 + e^{-z}}$$



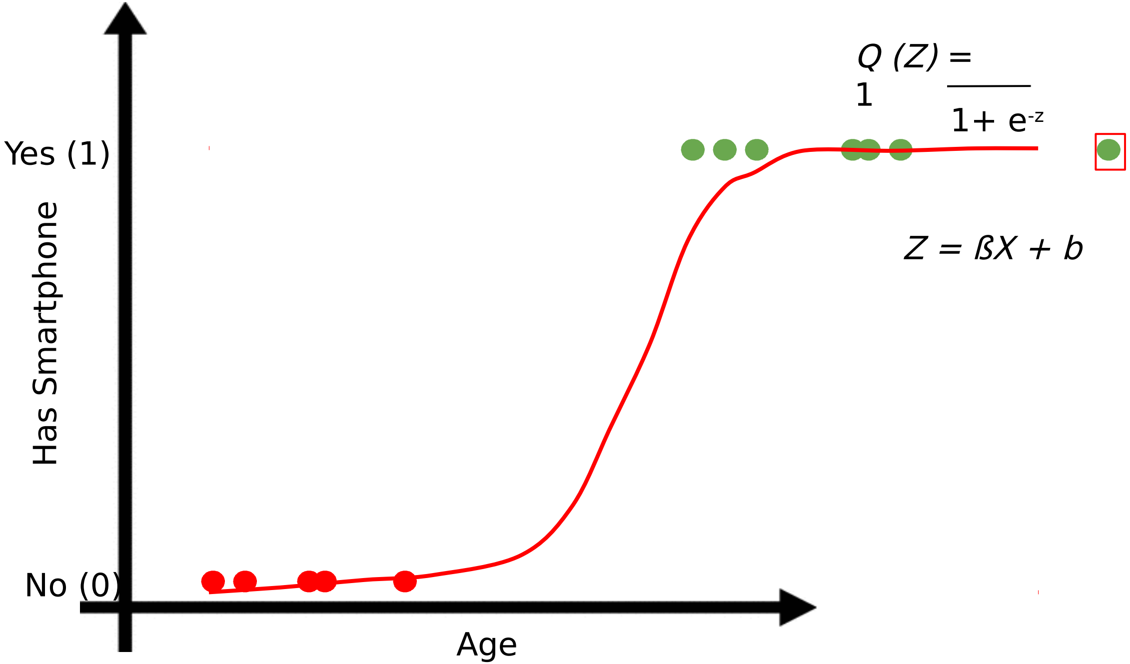
Logistic Regression

$$Z = \beta X + b$$

$$\hat{Y} = Q(Z)$$

$$Q(Z) = \frac{1}{1+e^{-z}}$$

$$\boxed{\hat{Y} = \frac{1}{1+e^{-z}}}$$



Logistic Regression

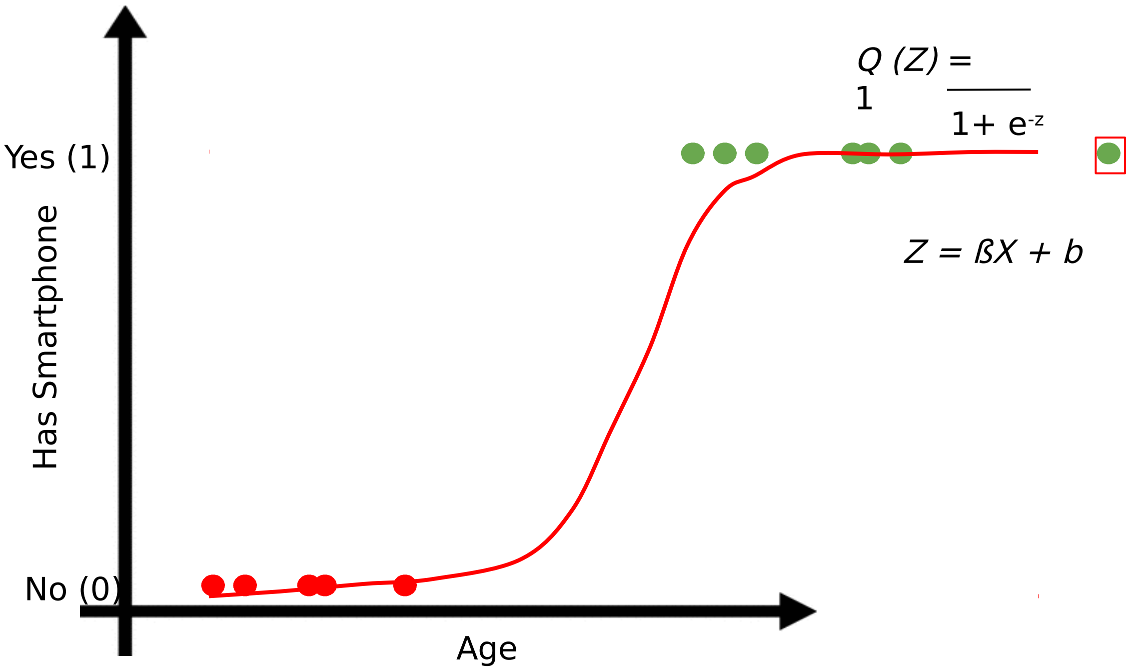
$Z = ßX + b$

$\hat{Y} = Q(Z)$

$Q(Z) = \dfrac{1}{1+ e^{-z}}$

$$\boxed{\hat{Y} = \dfrac{1}{1+ e^{-z}}}$$

$\hat{Y} = \dfrac{1}{1+ e^{-(ßX + b)}}$



Logistic Regression

Linear Regression
Cost Function

$$J = \frac{\sum_{i=1}^{n} (\hat{Y}_i - Y_i)^2}{n}$$

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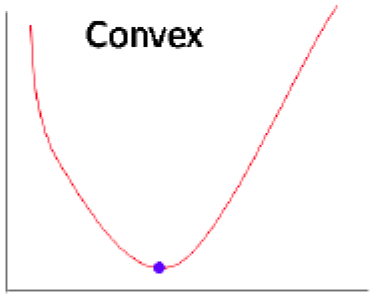
Logistic Regression

Linear Regression
Cost Function

$$J = \frac{\sum_{i=1}^{n} (\hat{Y}_i - Y_i)^2}{n}$$



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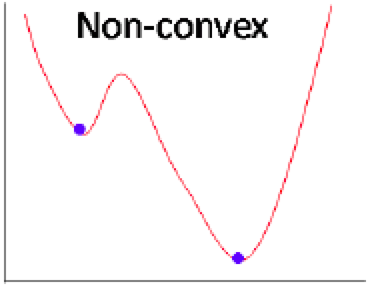
Logistic Regression

Linear Regression
Cost Function

$$J = \frac{\sum_{i=1}^{n} (\hat{Y}_i - Y_i)^2}{n}$$

$$\hat{Y} = \frac{1}{1 + e^{-Z}}$$



Logistic Regression

$$\text{Log loss} = \frac{1}{N} \sum_{i=1}^{N} - \left(y_i * \log(p_i) + (1-y_i) * \log(1-p_i) \right)$$

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Logistic Regression

$$\text{Log loss} = \frac{1}{N} \sum_{i=1}^{N} -\left(y_i * \log(p_i) + (1-y_i) * \log(1-p_i) \right)$$

$$\text{Log loss} = \frac{1}{N} \sum_{i=1}^{N} -\left(y_i * \log(\hat{Y}_i) + (1-y_i) * \log(1-\hat{Y}_i) \right)$$

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Logistic Regression

Logistic Regression Cost Function

$$J = \frac{1}{N} \sum_{i=1}^{N} -(y_i * \log (\hat{Y}_i) + (1- y_i)* \log (1-\hat{Y}_i))$$

$$\hat{Y} = \frac{1}{1+ e^{-z}}$$

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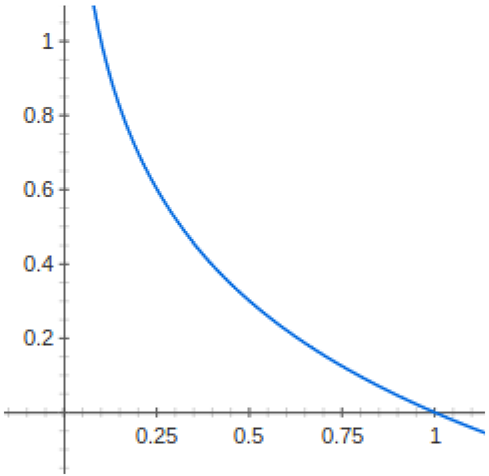
Logistic Regression

Logistic Regression Cost Function

$$J = \frac{1}{N} \sum_{i=1}^{N} -(\mathbf{y_i * \log (\hat{Y}_i)} + (1- y_i)* \log (1-\hat{Y}_i))$$

$$\hat{Y} = \frac{1}{1+ e^{-Z}}$$

When y=1



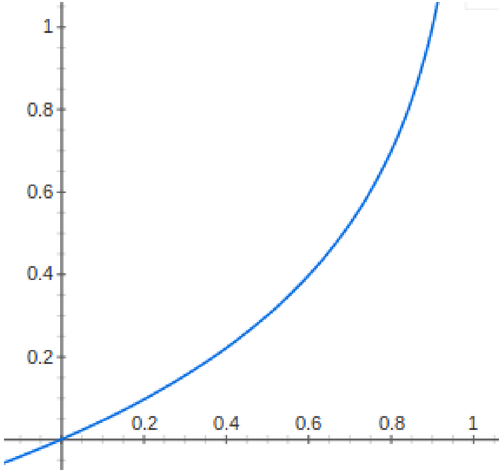
Logistic Regression

Logistic Regression Cost Function

$$J = \frac{1}{N} \sum_{i=1}^{N} -\left(y_i * \log(\hat{Y}_i) + \mathbf{(1 - y_i) * \log(1 - \hat{Y}_i)} \right)$$

$$\hat{Y} = \frac{1}{1 + e^{-z}}$$

When y=0



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Logistic Regression

Logistic Regression Cost Function

$$J = \frac{1}{N} \sum_{i=1}^{N} -\left(y_i * \log(\hat{Y}_i) + (1 - y_i) * \log(1 - \hat{Y}_i) \right)$$

$$\hat{Y} = \frac{1}{1 + e^{-Z}}$$

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Logistic Regression

Logistic Regression Cost Function

$$J = \frac{1}{N} \sum_{i=1}^{N} -(y_i * \log (\hat{Y}_i) + (1- y_i)* \log (1- \hat{Y}_i))$$

$$\hat{Y} = \frac{1}{1+ e^{-Z}} = \frac{1}{1+ e^{-(ßXi + b)}}$$

Logistic Regression

$$J = \frac{\sum_{i=1}^{n} -(Y_i \log(\hat{Y}_i) + (1-Y_i)\log(1-\hat{Y}_i))}{n}$$

$$Z_i = ßX_i + b$$

$$\hat{Y}_i = \frac{1}{1+e^{-Z_i}}$$

$$G_ß = \frac{\partial(J)}{\partial ß} = \frac{-2\sum(\hat{Y}_i - Y_i)X_i}{n}$$

$$G_b = \frac{\partial(J)}{\partial b} = \frac{-2\sum_{i=1}^{n}(\hat{Y}_i - Y_i)}{n}$$

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Logistic Regression

$$J = \frac{\sum_{i=1}^{n} -\left(Y_i \log(\hat{Y}_i) + (1-Y_i)\log(1-\hat{Y}_i)\right)}{n}$$

$$Z_i = ßX_i + b$$

$$\hat{Y}_i = \frac{1}{1+e^{-Z_i}}$$

$$G_ß = \frac{\partial(J)}{\partial ß} = \frac{-2\sum_{i=1}^{n}(\hat{Y}_i - Y_i)X_i}{n} = \frac{-2}{n}\sum_{i=1}^{n}\left(\frac{1}{1+e^{-(ßX_i+b)}} - Y_i\right)X_i$$

$$G_b = \frac{\partial(J)}{\partial b} = \frac{-2\sum_{i=1}^{n}(\hat{Y}_i - Y_i)}{n} = \frac{-2}{n}\sum_{i=1}^{n}\left(\frac{1}{1+e^{-(ßX_i+b)}} - Y_i\right)$$

Logistic Regression

$$J = \frac{\sum_{i=1}^{n} -\left(Y_i \log(\hat{Y}_i) + (1-Y_i)\log(1-\hat{Y}_i)\right)}{n}$$

$$ß = ß - \alpha G_{ß}$$

$$b = b - \alpha G_b$$

$$G_{ß} = \frac{\partial(J)}{\partial ß} = \frac{-2\sum_{i=1}^{n} (\hat{Y}_i - Y_i)\, X_i}{n} = \frac{-2}{n} \sum_{i=1}^{n} \left(\frac{1}{1+e^{-(ßXi+b)}} - Y_i \right) X_i$$

$$G_b = \frac{\partial(J)}{\partial b} = \frac{-2\sum_{i=1}^{n} (\hat{Y}_i - Y_i)}{n} = \frac{-2}{n} \sum_{i=1}^{n} \left(\frac{1}{1+e^{-(ßXi+b)}} - Y_i \right)$$