Logistic Regression using an OLS Shortcut

Goal: Model a binary outcome involving a single continuous predictor.

Approach: Use an OLS shortcut that avoids complexity of MLE


Step-by-step procedure

1. Enter continuous predictor data in col A, binary outcome in col B.
2. Sort data in first 2 columns in ascending order by Col A.
3. Generate appropriate summaries to create linear and logistic.
4. Enter linear in C2 (logistic in D2) and copy to bottom of data.
5. Create XY-plot with 3 series. Format and title as needed.
6. Answer three questions.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Height</th>
<th>Male</th>
<th>Linear</th>
<th>Logistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>G</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean0</td>
<td>65.4</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mean1</td>
<td>70.8</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Difference</td>
<td>5.354</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Regress binary on continuous predictor using OLS

OLS Intercept: \(-5.928\) = \(\text{INTERCEPT}(B2:B1000, A2:A1000)\)
OLS Slope: \(0.0953\) = \(\text{SLOPE}(B2:B1000, A2:A1000)\)

Linear: \(C2 = G21 + G22*A2\) Enter formula in C2; copy

Xo: \(67.46 = (0.5-G21)/G22\) \(X = Xo\) if \(P(Y) = 0.5\)

R-squared: \(0.51 = \text{CORREL}(A2:A1000, B2:B1000)^2\)

If \(R^2 > 0.4\), you can use the following logistic shortcut.

Logistic: \(D2 = 1/(1+\exp(4*(G24-A2) / G18))\)

Based on the logistic, what is the chance that a randomly selected subject is male …

Q1 given that they are 62" tall? 
Q2 given that they are 65" tall? 
Q3 given that they are 70" tall?

Chance of Being Male Given Height

Linear & Logistic