Questions

Section 1: Phenotyping Corn Seedlings.

Q1. What is quantitative trait? Is leaf angle a quantitative trait?

Q2. Which maize genotype that you phenotyped had the largest 2nd leaf angle? Which one had the smallest, most upright 2nd leaf angle?

Q3. Which maize genotype that you phenotyped had the largest 3rd leaf angle? Which one had the smallest, most upright 3rd leaf angle?

Standard deviation (SD) is an important statistic that is used to measure the amount of variation in a set of values. SD can be calculated in Microsoft Excel with the function *STDEV()* by typing = *STDEV()* in a cell and then highlighting the numbers that you want to measure SD for.

Q3. What is the SD of the 2nd and 3rd leaf angles within each genotype that you phenotyped? What do these statistics say about the data you collected?

Section 2: Phenotype leaf angles of corn seedlings using computational methods.

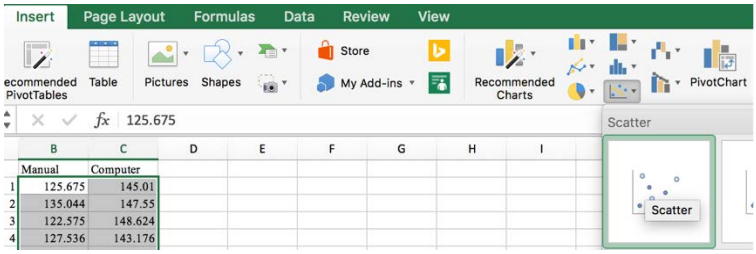
Using both manual and 2D image-based (provided by *PlantCV*) data that you collected on the leaf angles of the 2nd and 3rd leaves, you can test whether the image-based data are good proxies for the "ground truth" hand measurements using linear regression.

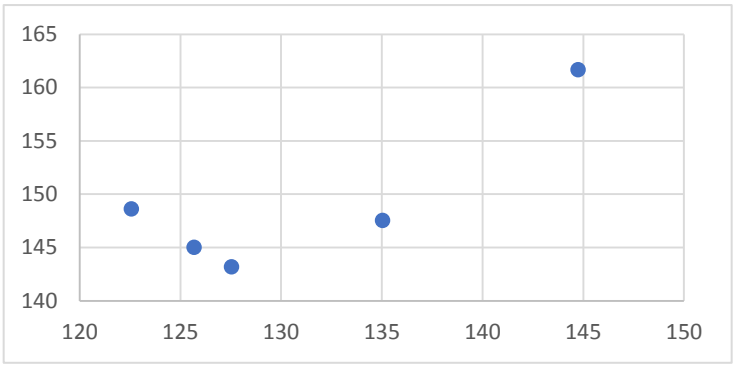
How to do it…

a. Input your 2nd leaf data from both manual and image-based measurements into Microsoft Excel (see diagram to the right for a template on how to input your data into Excel). Excel can be used to model the linear relationship between the two measurements.
b. Highlight the data.

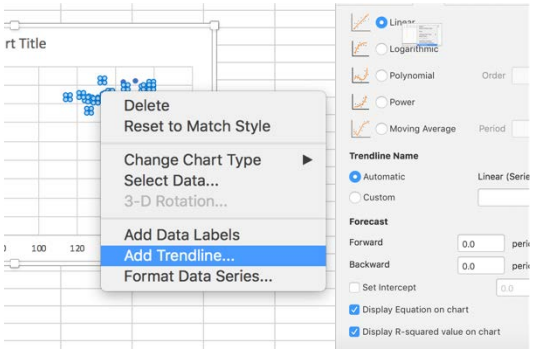
	A	B	C	D
	Plant	Manual	Computer	
	1	125.675	145.01	
	2	135.044	147.55	
	3	122.575	148.624	
	4	127.536	143.176	
	5	144.752	161.685	

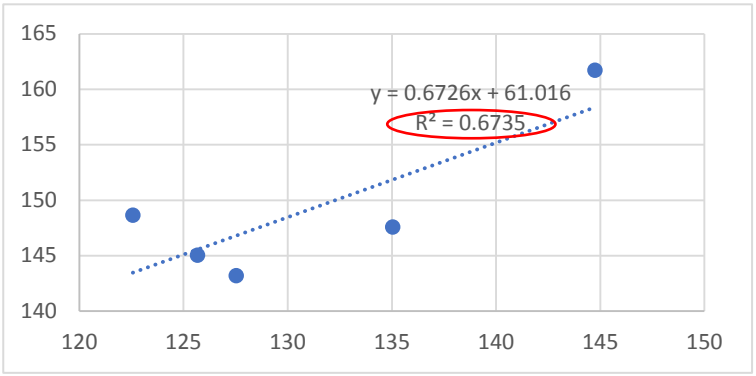
c. From the “Insert” tab, click on the Scatter Plot. This will generate a Scatter Plot which plots the Manual data on the x axis and the image-based data on the y axis.





d. Select any data point on the Scatter Plot and right click to open the dropdown menu. Choose “Add Trendline” and then click “A linear relationship”, “Automatic”, “Display Equation on chart”, and “Display R-squared value on chart”. A trendline will be added on your chart over the data points. In addition, the R^2 value, the indicator of the goodness of fit (shown in the red oval), and the equation of the trendline (y = mx +b) will be shown on the Scatter Plot.





y is the response variable (image-based measurement);
x is the explanatory variable (hand measurement);
m is the linear slope related x to y;
b is the intercept.

How do you interpret the trendline and the R^2 value in your scatterplot? What do they mean? The trendline is generated with the smallest possible distance between the line and all data points. The R^2 value is the Coefficient of Determination, and describes how closely the data points are to the trendline. An R^2 value of 1 means there is a strong relationship while an R^2 value of 0 means there is no relationship at all.

Q4. What is the R^2 value of your data? How well do the computational measurements fit the hand measurements?

Repeat Section 2 for the manual and image-based measurements of the 3rd leaf data.