



A new app for smartphones to count the number of flowers per inflorescence under field conditions

M.P. Diago, Arturo Aquino, Salvador Gutiérrez, Daniel Gastón, Borja Millán, J. Tardaguila..



Why counting the flowers of a grapevine inflorescence?

- ✦ Flowering and fruit set are main determinants of grapevine yield
- ✦ They define the number of berries per cluster, influencing cluster architecture and compactness

$$\text{Fruit set rate}(\%) = \frac{\# \text{berries}}{\# \text{flowers}} * 100$$



How can we count flowers ?

- * Collection and manual count of collected flower caps in bagged inflorescences



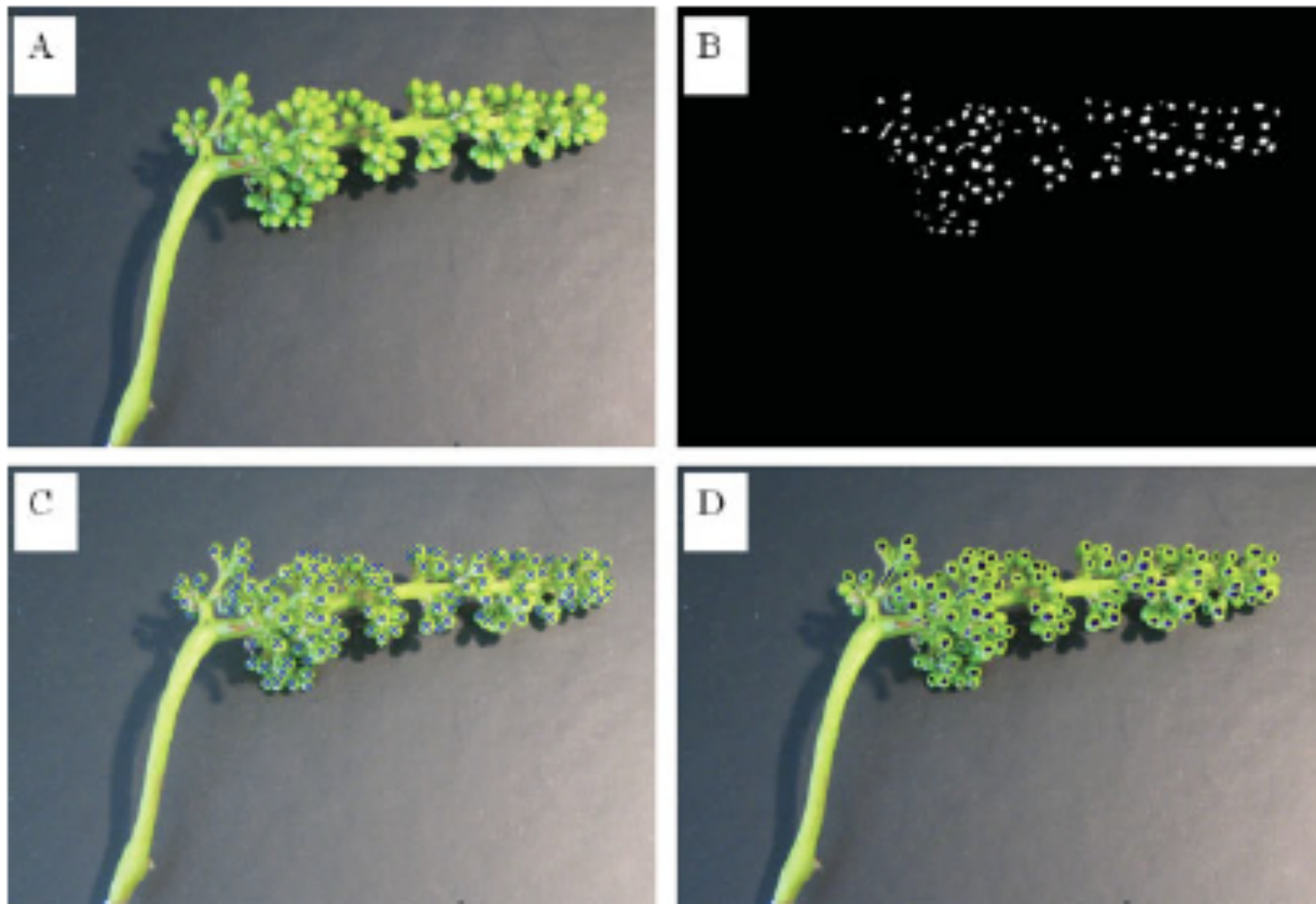
flower cap-fall sequence
stain (richard@susanart.com)

These methods are
either destructive
and/or time and
labour consuming

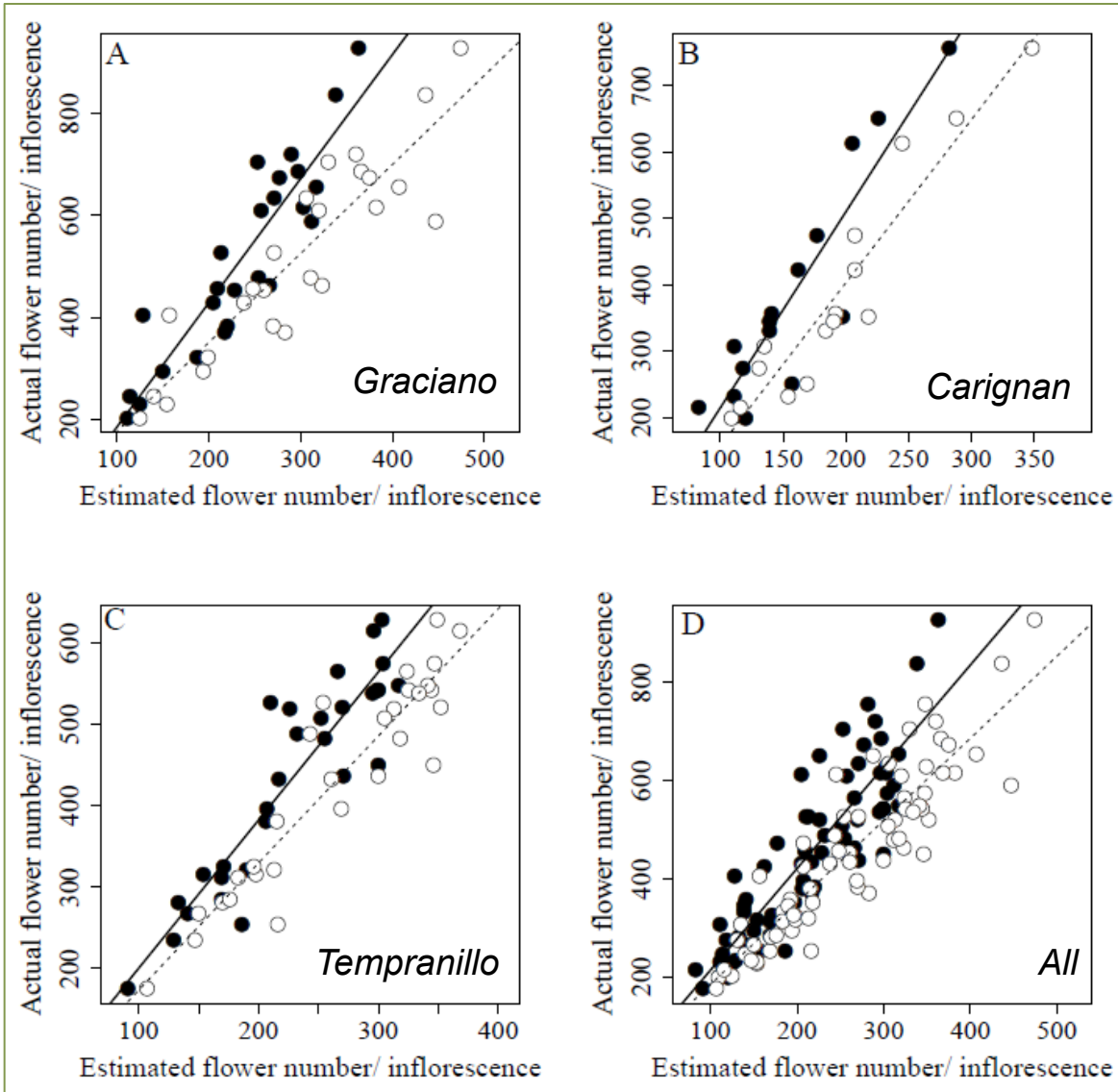
- * Manual counting of flowers

Poni et al. (2006) AJEV 57, 397-407

Using image-analysis to detect and count flowers



Using image-analysis to detect and count flowers



○ Manual
● Automated

$R^2 \approx 0.80$



Home page

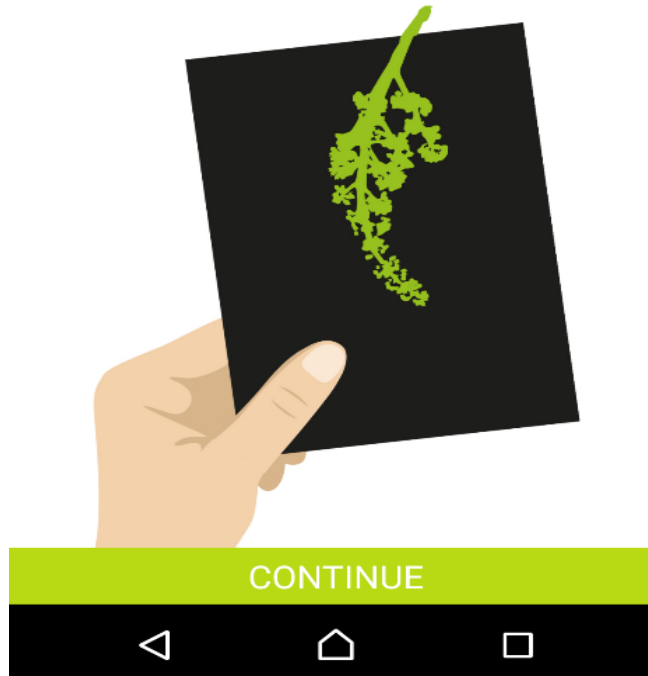
Key points to consider before using the vitisFlower app

- ✦ Inflorescences have to be at phenological stage BBCH 55-57
- ✦ Always use a black background





Take the capture placing a black cardboard behind the inflorescence. The scene in the capture must be completely covered by the cardboard.



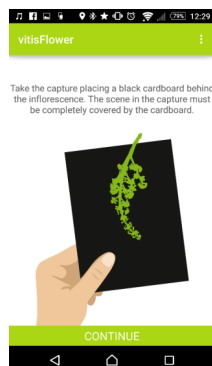
Home page

How to use the app

- * Avoid shadows
- * Do not use flash light
- * Images have to be focused



Home page



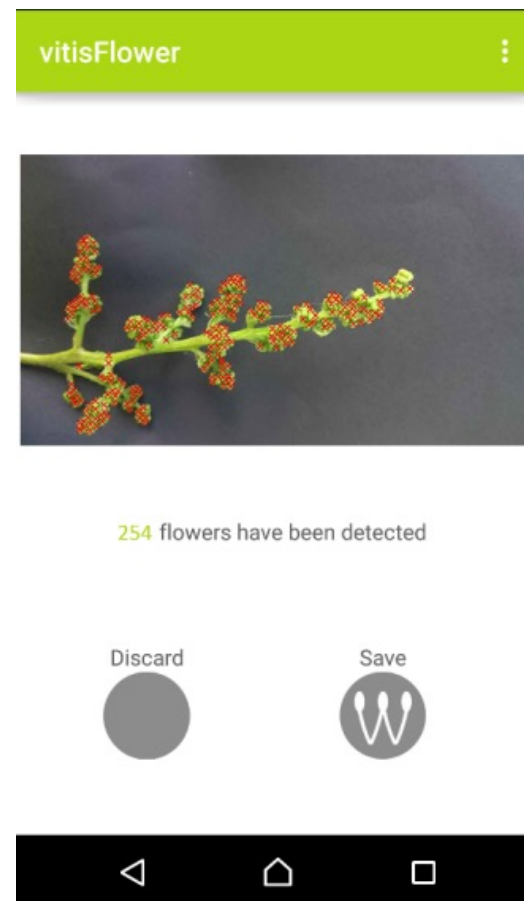
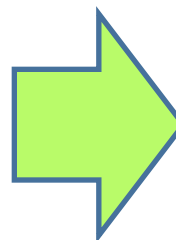
How to use the app



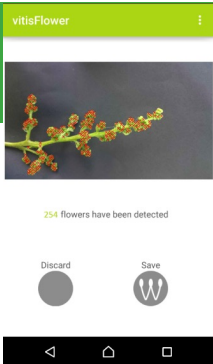
Image capture



Image capture



Results



Results

Precision & Recall

Sony Xperia Z2			BQ Aquaris E5		
Variety	\overline{RC}	\overline{PR}	Variety	\overline{RC}	\overline{PR}
Airen	0.8223	0.9787	Merlot	0.9173	0.9517
Cabernet Sauvignon	0.8363	0.9615	Cabernet Sauvignon	0.8855	0.9531
Chardonnay	0.8770	0.9339	Chenin Blanc	0.7987	0.9563
Grenache	0.8045	0.9763	Grenache	0.8391	0.9685
Riesling	0.8411	0.9458	Riesling	0.9035	0.9212
Syrah	0.8889	0.9376	Sauvignon Blanc	0.8664	0.9557
Tempranillo	0.8308	0.9851	Semillon	0.8826	0.9158



254 flowers have been detected

Discard



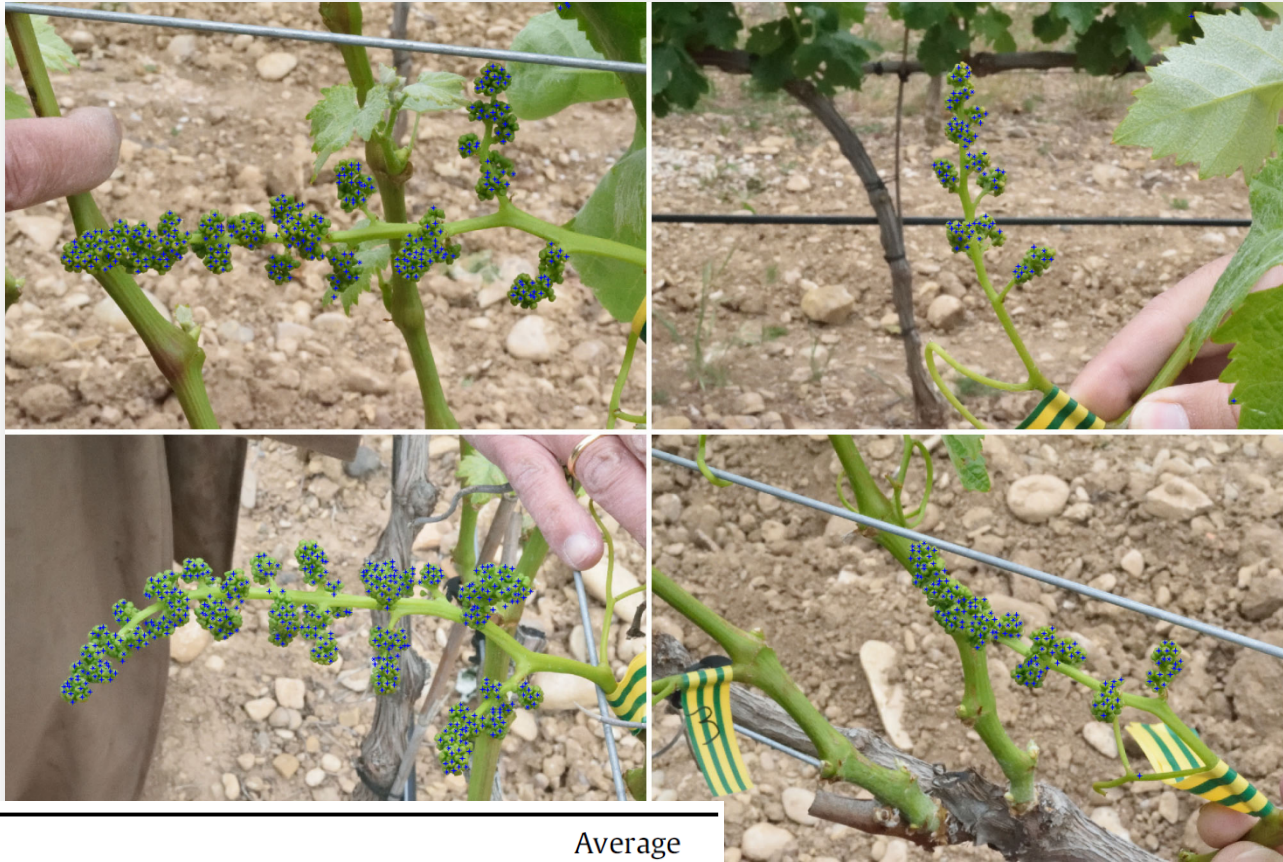
Save



Results

- ✳ The number of flowers per inflorescence can be fast, successfully and non-destructively estimated using a friendly image-based app for any smart device.

* Removal of dark background for image acquisition



Metric	Average
<i>This work</i>	
Actual flowers in the gold standard set	225.65
PC	0.8338
RC	0.8501



Thank you!



<http://televitis.unirioja.es/en/>



KBBE-311775



VITIS NAVARRA®
GENÉTICA Y PLANTAS DE VID

@Televitis 