Using robots to characterize genotype by environment interactions through developmental time

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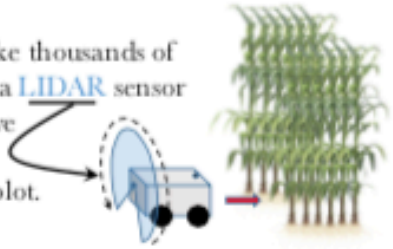
By facilitating daily, field-scale data collection with millimeter precision, rover-based phenotyping will enable unprecedented temporal resolution for studying **interactions between genotype (G), environment (E), and developmental time (T)**.

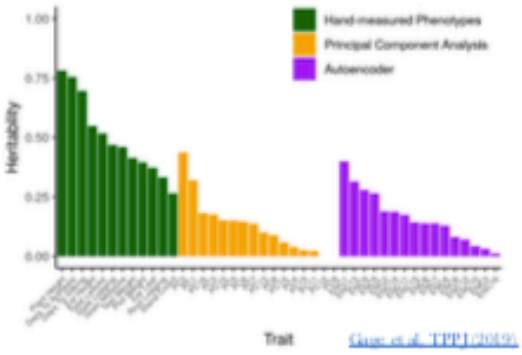
Rovers are affordable, autonomous, and scalable.

Rovers make thousands of scans with a LIDAR sensor as they drive through each field plot.



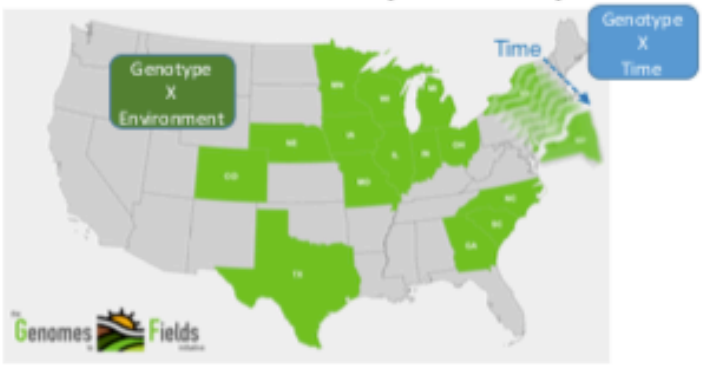
LIDAR data are processed to produce 3D reconstructions of field plots.

LIDAR data are summarized by dimensionality reduction to produce heritable descriptors of whole-plant architecture that are not constrained to human-defined traits like plant height or leaf count.

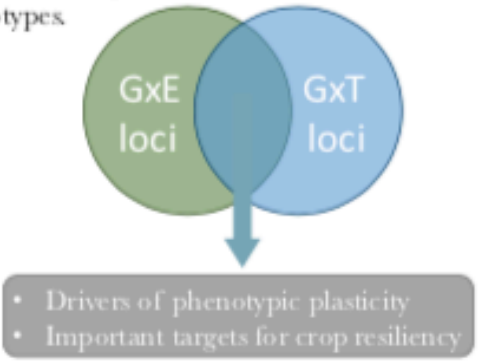


Gage et al. TPPJ (2019)

Rovers enable longitudinal data collection at densely spaced timepoints in NY. The same germplasm is also grown in dozens of environments as part of Genomes to Fields. These data allow comparison of genotype interactions with different dimensions: spatial and temporal.



Hypothesis:
Common genetic control determines both differential developmental trajectories and differential response to environments between genotypes.



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