SMART IRRIGATION:

Big Data approach for accurate water stress detection and precision irrigation in vineyards
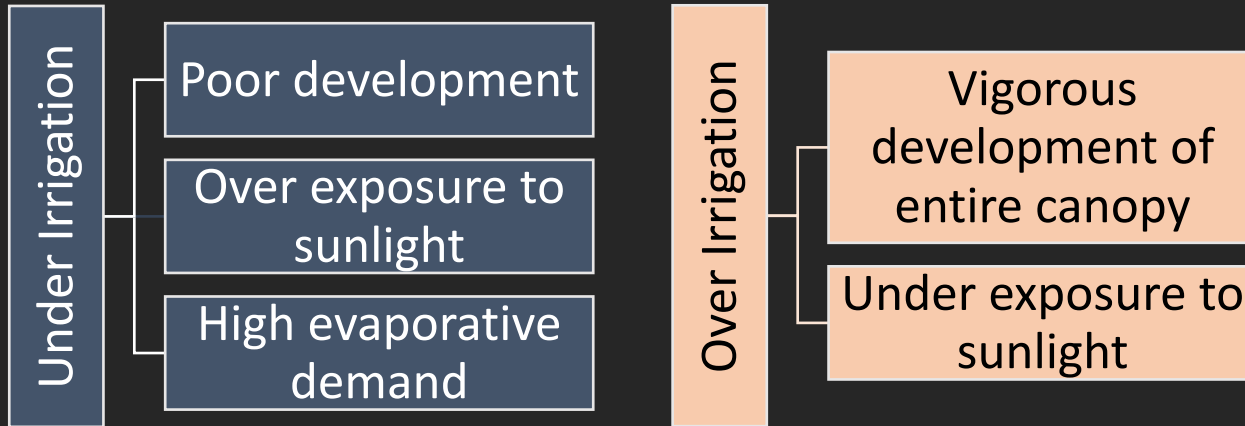
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Description

Under Irrigation	Poor development
	Over exposure to sunlight
	High evaporative demand

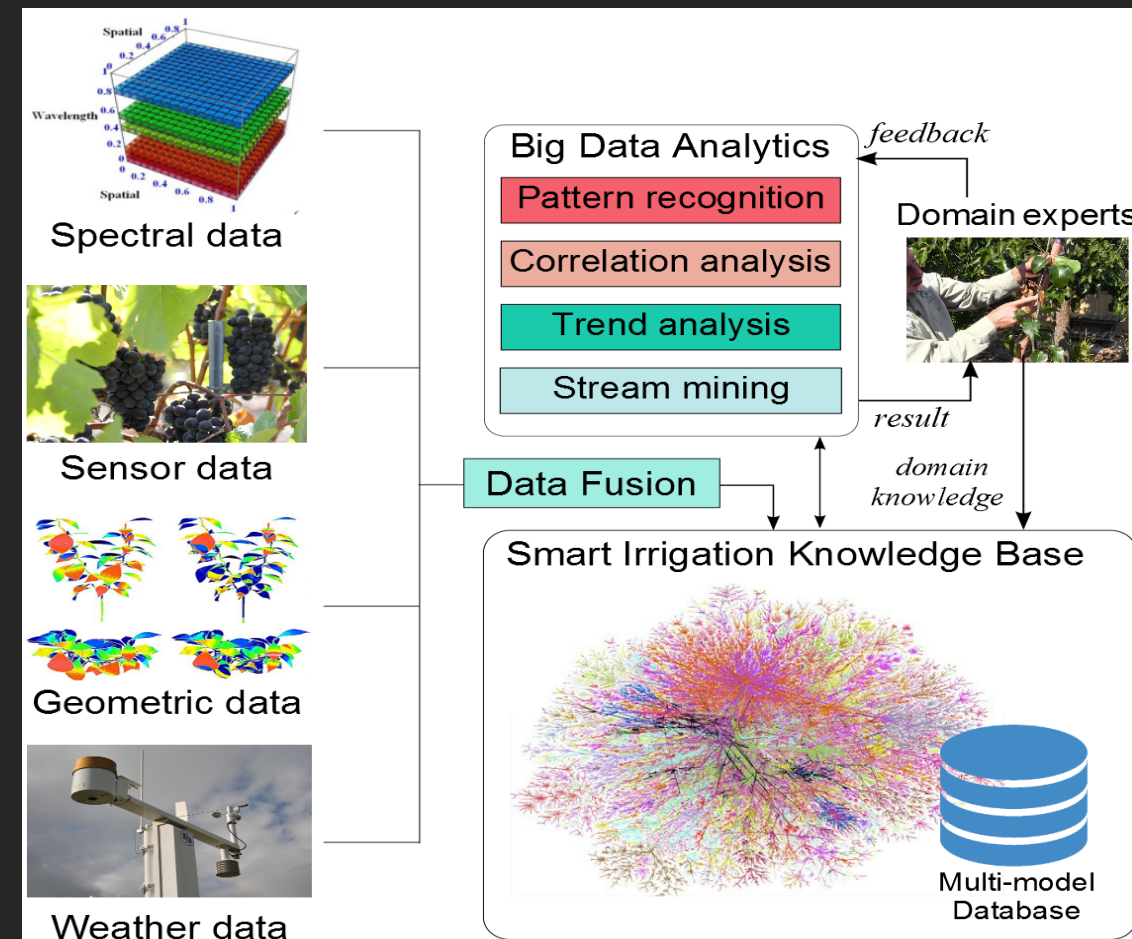| Over Irrigation	Vigorous development of entire canopy
	Under exposure to sunlight

Project Objectives

❖ Develop robust and reliable approaches for estimating plant water stress using multi-source data and Big Data analytics

❖ Develop decision-support tools for automated scheduling of precision irrigation

4/8/20

Current Water Stress Sensing Techniques

Plant/Soil-based

Inaccurate estimations
Labor intensive

Non-contact Sensing

Mostly aerial studies
Disregard variability

Spectral data

Sensor data

Geometric data

Weather data

Data Fusion

Big Data Analytics
- Pattern recognition
- Correlation analysis
- Trend analysis
- Stream mining

Domain experts

feedback

result

domain knowledge

Smart Irrigation Knowledge Base

Multi-model Database

Progress and Findings

Vegetative Data

Shoot length
Leaf number
Periderm formation

Canopy architecture

Shoot number
Lateral leaf number
Lateral shoot number
Solar interception
Shaded area
Sun-exposed clusters

Yield components

Cluster number
Cluster weight
Berry number
Berry weight

Fruit composition

Soluble solids
Titratable acidity
pH

$r = 0.66$, $P < 0.001$, $n = 287$

- FULL
- RDI

Relationship between midday leaf water potential (Ψ_{leaf}) and soil moisture (θ_v)

Mapping LWP (bars) over the field

Mapping PRI over the field

Relationship between observed mid-day leaf water potential (LWP) and Photochemical Reflectance Index (PRI)
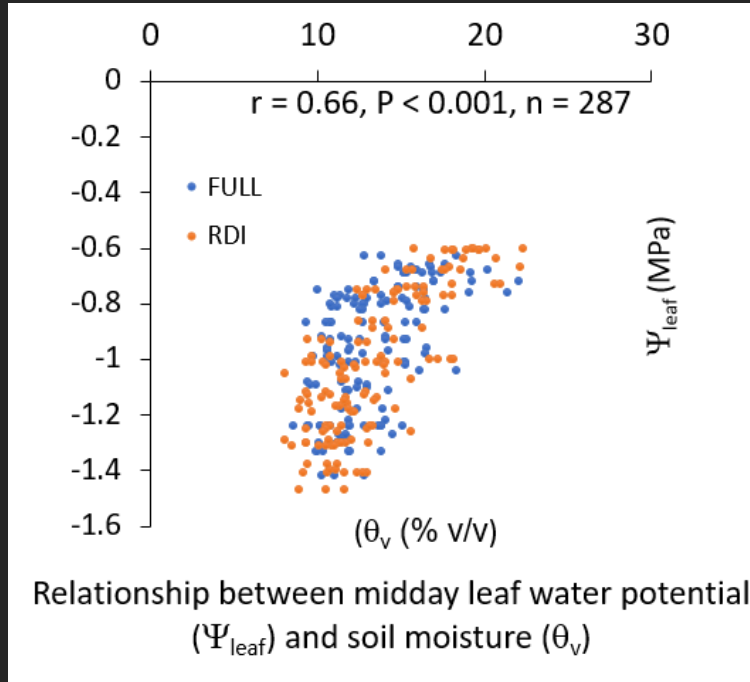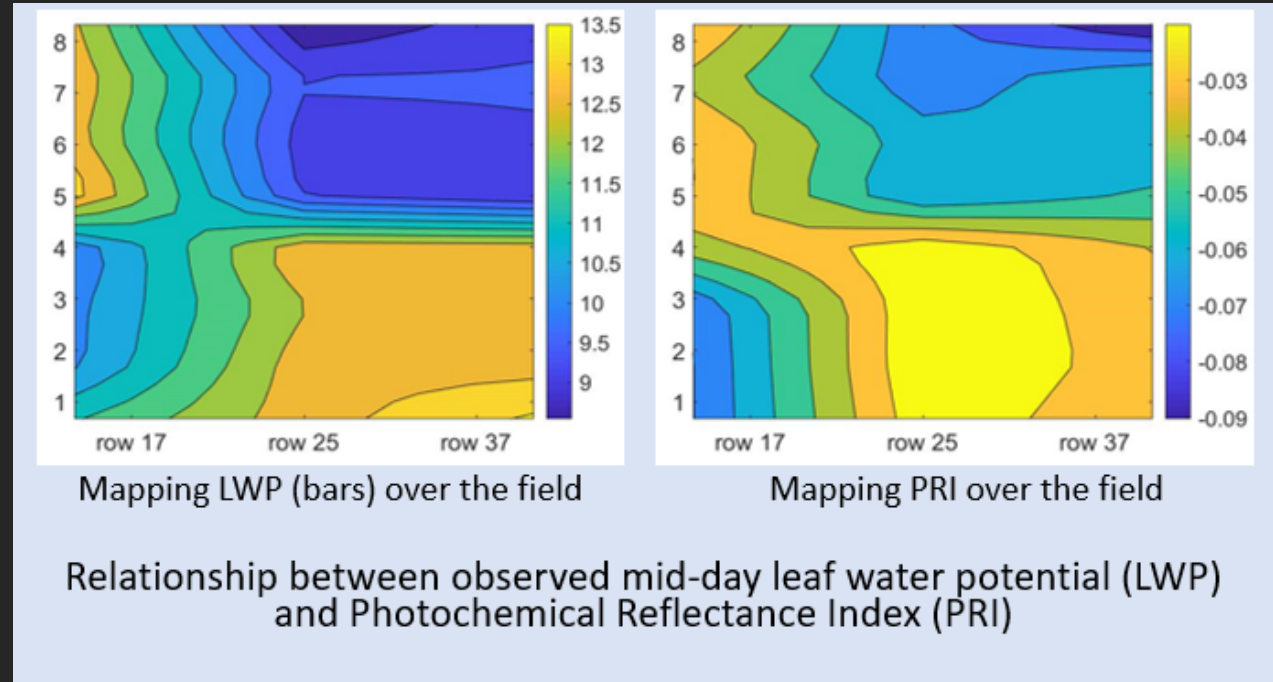
Image Data

3D variability of Color, Infrared, Thermal and Geometric signatures within canopy and across the field

- New algorithm developed for knowledge base construction over Ag Sensor Data

- A new tool developed for cleaning and integrating knowledge from noisy ag sensor network