

2020
embedded
VISION
summit®

Feeding the World Through Embedded Vision

Travis Davis
September 2020



JOHN DEERE

- John Deere Background
- What makes our solution space challenging (but awesome)
 - Hardware Examples
 - Solution Examples
- Production Considerations for Embedded Vision and Machine Learning
- Key Takeaways
- Q&A



John Deere Background

About John Deere

GLOBAL GROWTH



Agriculture Equipment



Turf Equipment



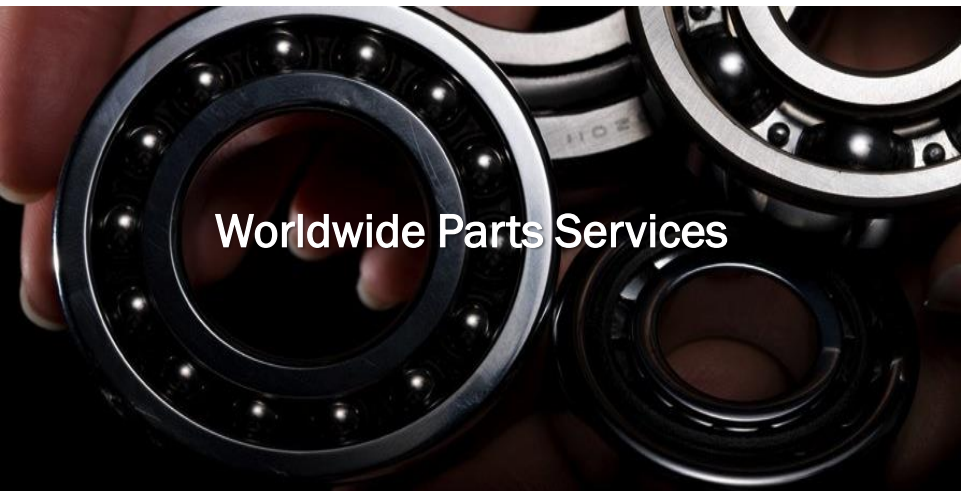
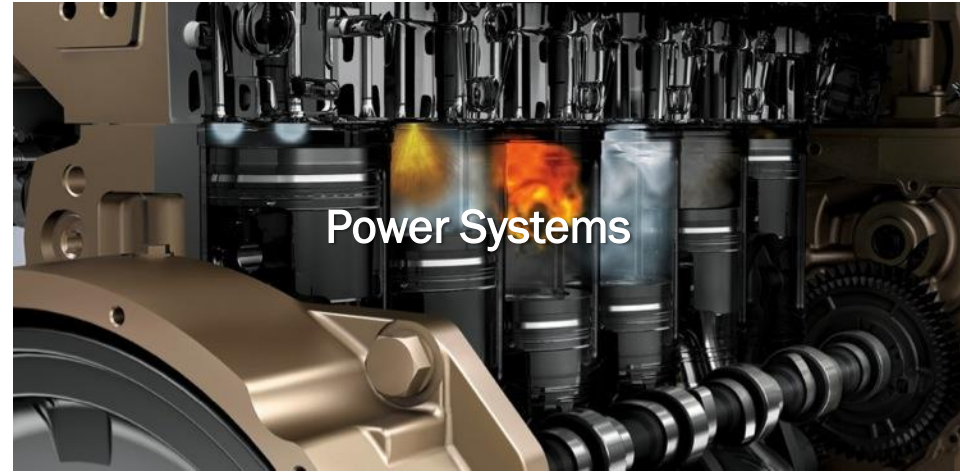
Construction Equipment



Forestry Equipment

COMPLEMENTARY

John Deere Supporting Operations

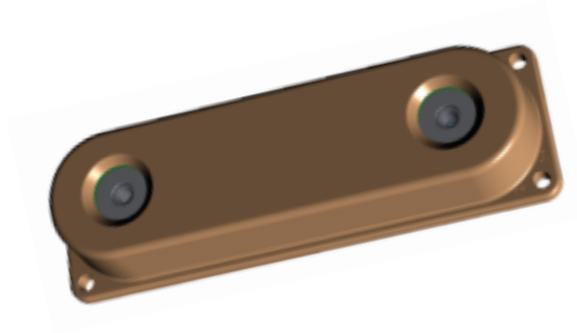


What makes our solution space challenging? Hardware Topics

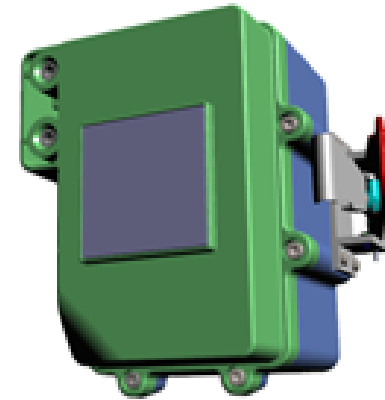
John Deere Embedded Vision Hardware



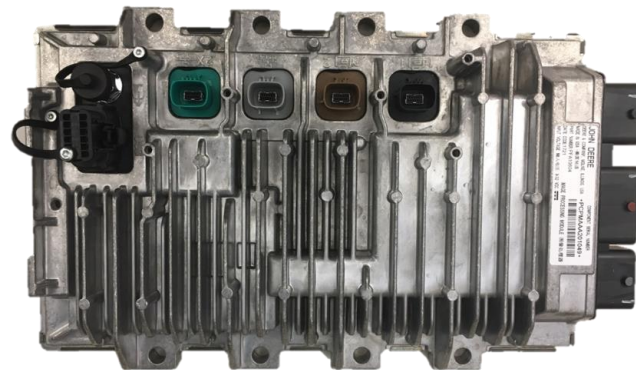
Monocular Camera



Stereo Camera



Grain Quality Camera



Vision Processor

John Deere Testing – Dust Testing



John Deere Testing – Cold Water “Splash”



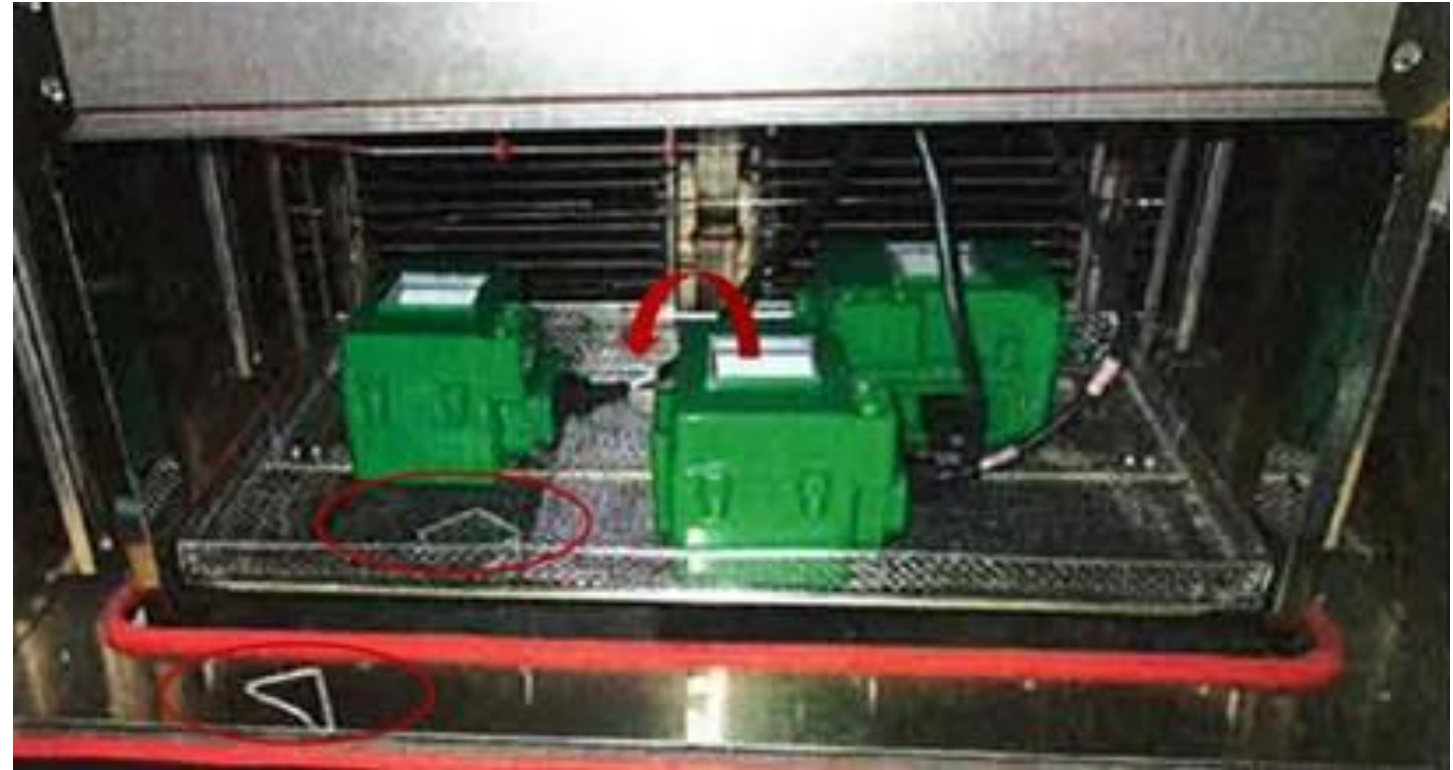
John Deere Testing – Vibration Test Example (Early Result – obviously fixed for production)



John Deere Testing – Vibration Test Example (Early Results – obviously fixed for production)



John Deere Temp Testing – Test Examples (Early Results – obviously fixed for production)



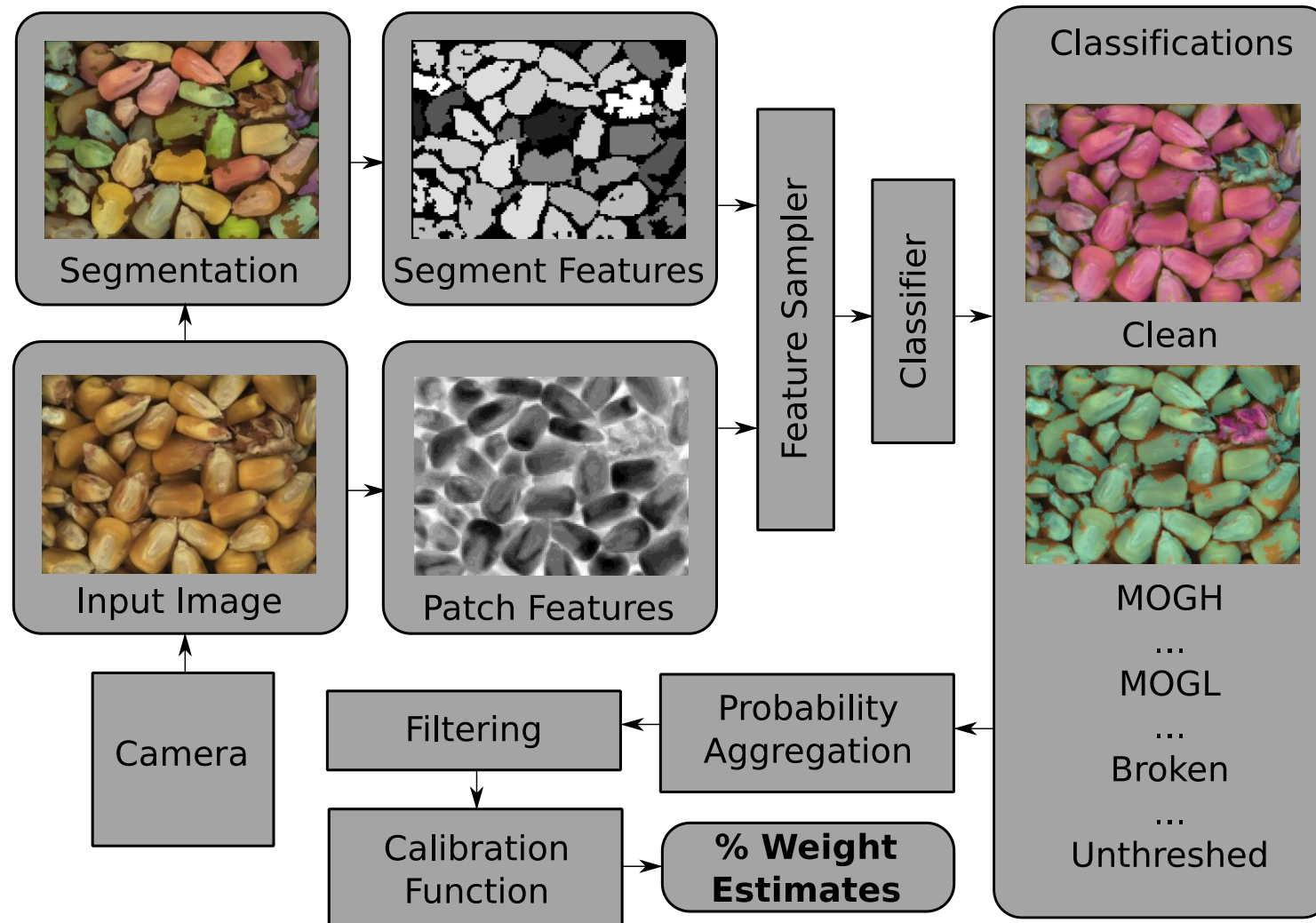
What makes our solution space challenging? Solution Examples

Challenging Solution Examples – Combine Advisor

Which Crop Types Are These?



Challenging Solution Examples – Combine Advisor



Challenging Solution Examples – Combine Advisor Harvesting in Standing Water



Challenging Solution Examples – Combine Advisor Harvesting in Standing Water



Challenging Solution Examples – Combine Advisor Weed Seeds



Challenging Solution Examples – Combine Advisor Dirt



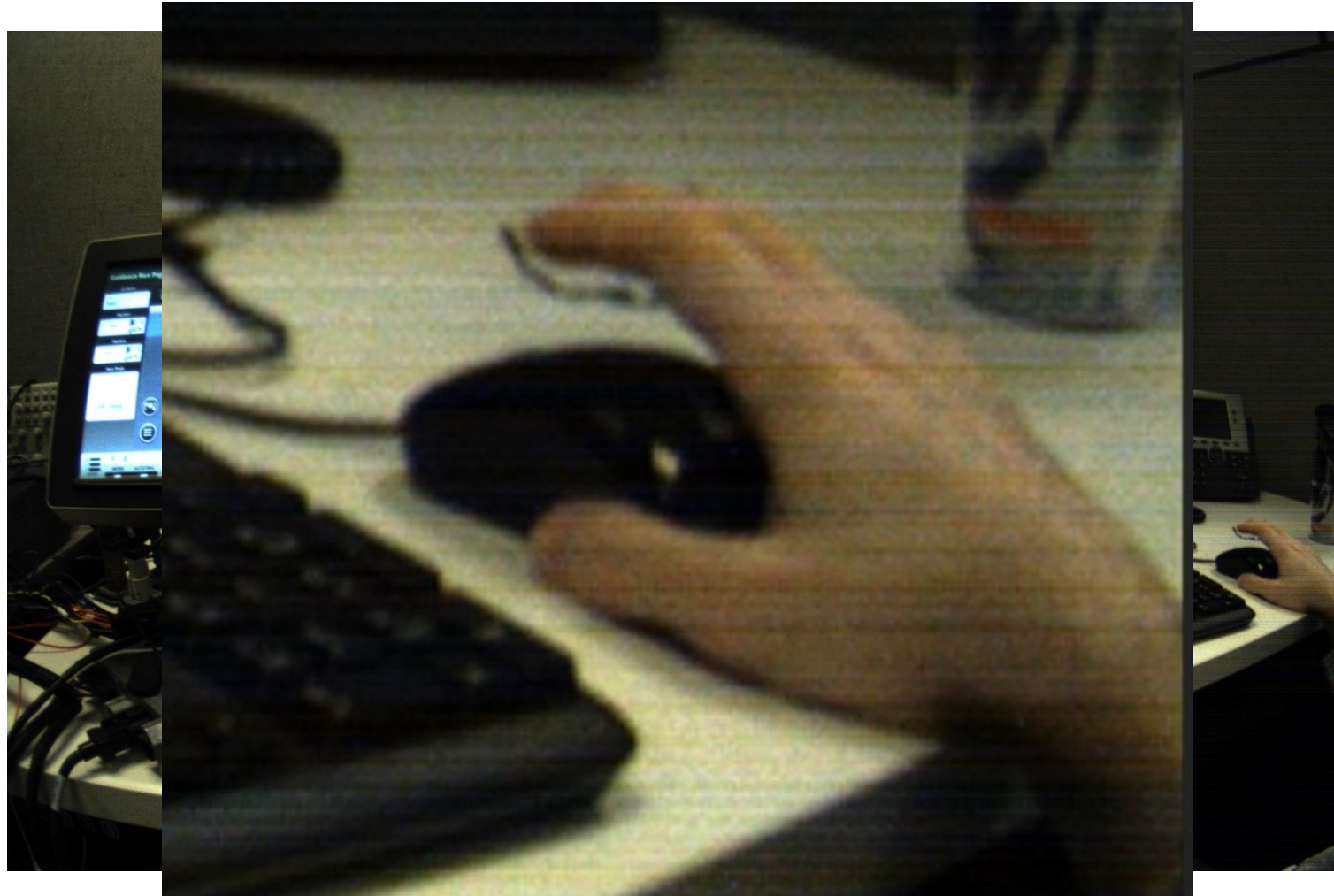
Challenging Solution Examples – Active Fill Control Trailer Varieties



Production Considerations for Embedded Vision or Machine Learning Technologies

Production Journey Image Processing Challenges – Examples

Image Quality Issue – Can you spot it?



Production Journey Image Processing Challenges – Examples

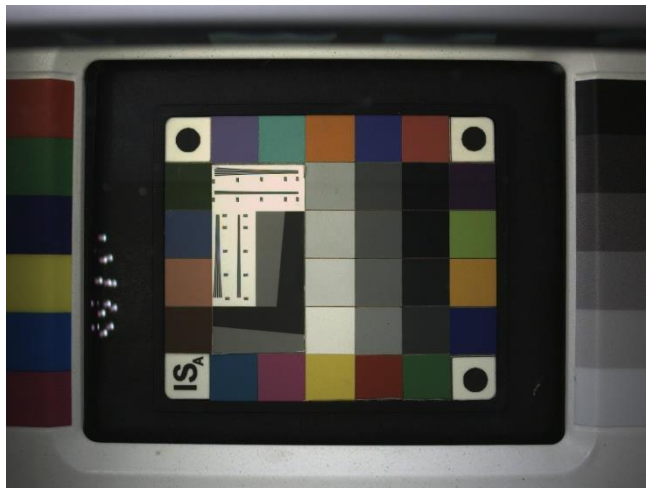
Can you spot the difference?



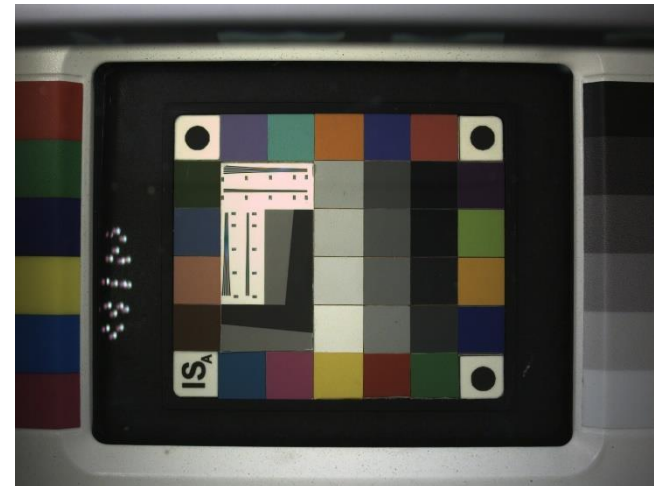
LED Bin "A"



LED Bin "B"



LED Bin "C"



LED Bin "D"

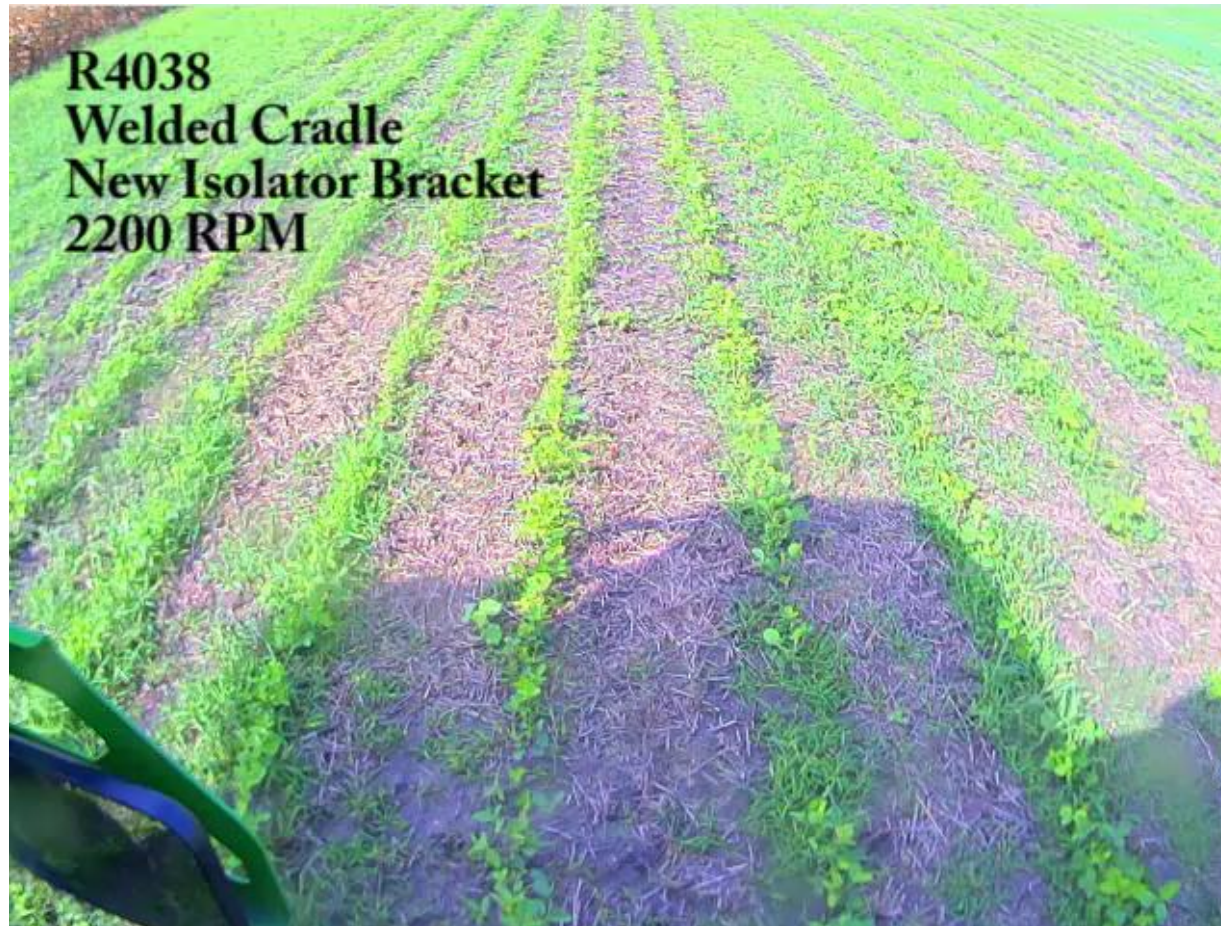
Production Journey Image Processing Challenges - Examples

Vibration Impact on Performance if not Addressed Appropriately



Production Journey Image Processing Challenges – Examples

Vibration Impact on Performance if not Addressed Appropriately



- Commercializing Image Processing & Machine Learning Is Orders Of Magnitude Harder Than Doing a Demonstration
 - Always Consider Your Environment that the Solution Needs to Operate & How You Communicate When It's Not Expecting to Operate
 - Hard Decisions Will Need to Be Made to Choose Between Application Performance and Long Term Performance
 - Choose an Image Processing or Machine Learning Design For Future Robustness
- Commercialization of Image Processing and Machine Learning Solutions Require High Levels of Consistency of Various Components
- John Deere is Helping to Feed the World Using Image Processing and Machine Learning (It's an awesome place to be!)

Q&A

Key partners on project examples:



Carnegie Mellon University



Various hardware and component suppliers

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