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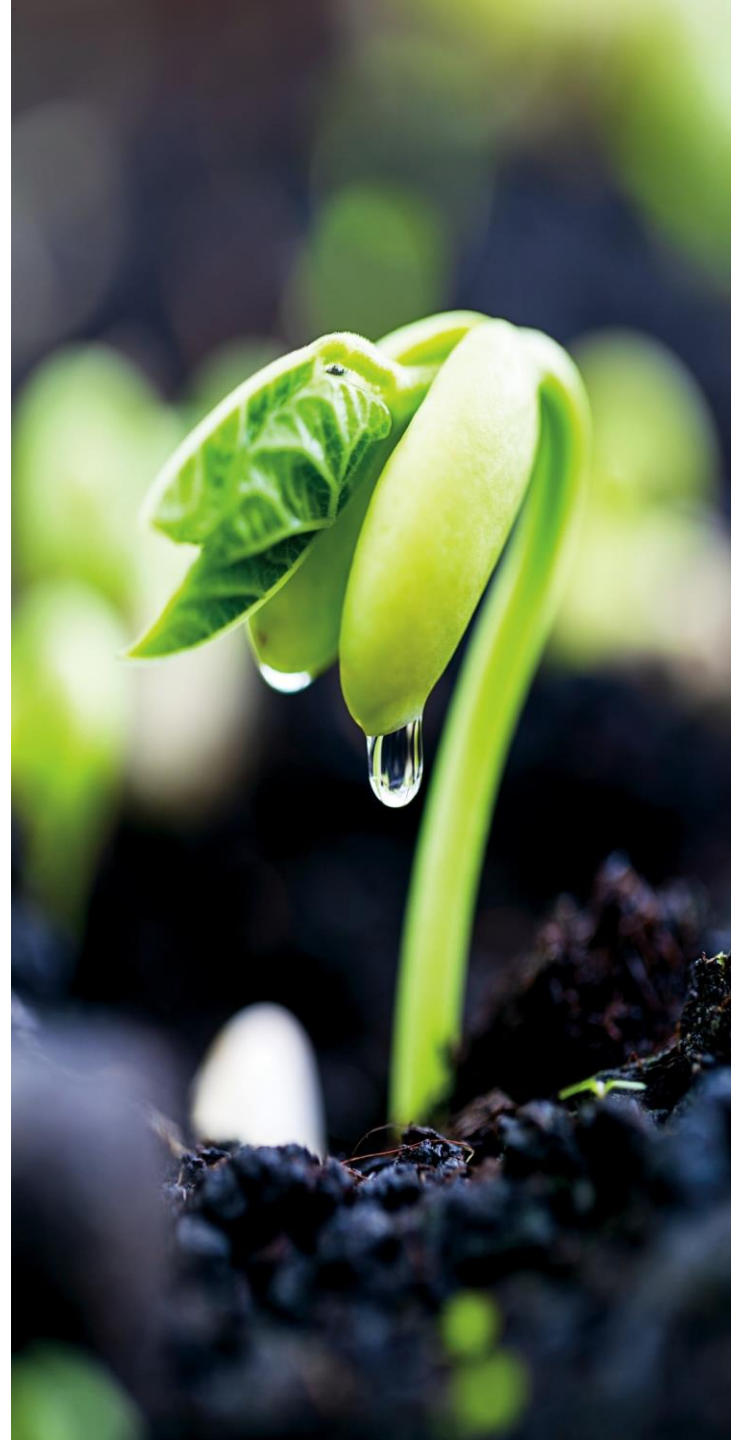
# Agri-Tech and Big Data



Winnipeg, Fairmont Hotel Oct 2nd-3rd 2017

Oct 3<sup>rd</sup> , 2017

Maurice Moloney Exec. Director and CEO



# Canadian Investments in AgriTech

**Canada has made substantial investments in AgriTech research, much of it involving Big Data.**

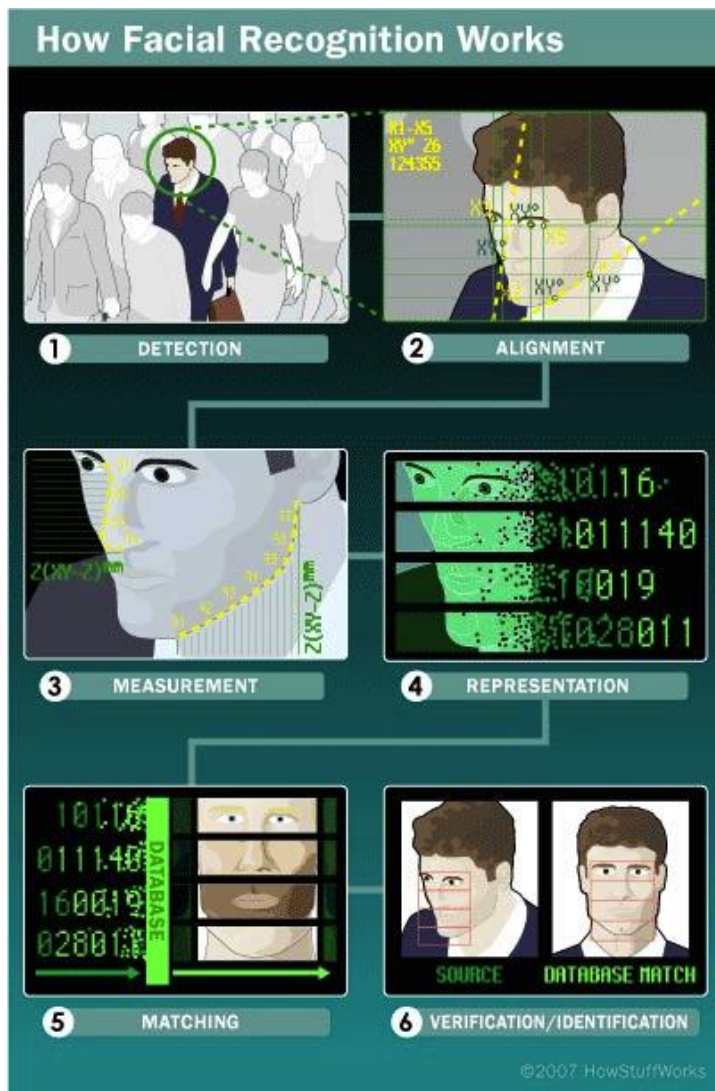
- Canada First Research Excellence Fund (CFREF), \$37 million on plant phenotyping (Saskatchewan)
- Canada First Research Excellence Fund (CFREF), \$77 million on sustainable food production (Guelph)

# What kinds of Data?

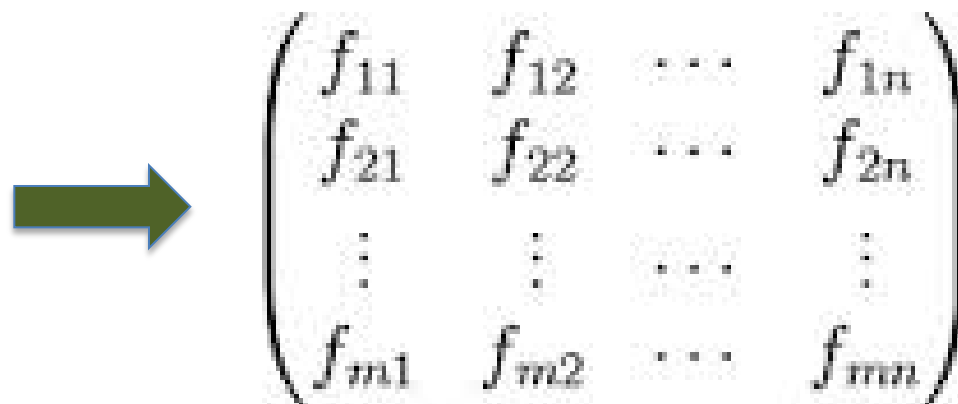
- Research Data with the potential for improving plant and animal breeding (eg phenotyping)
- Agronomic data leading to increases in efficiency in agricultural production
- Food supply and value chain data for increased efficiency, traceability and food safety



# Computational approaches to digital phenotyping



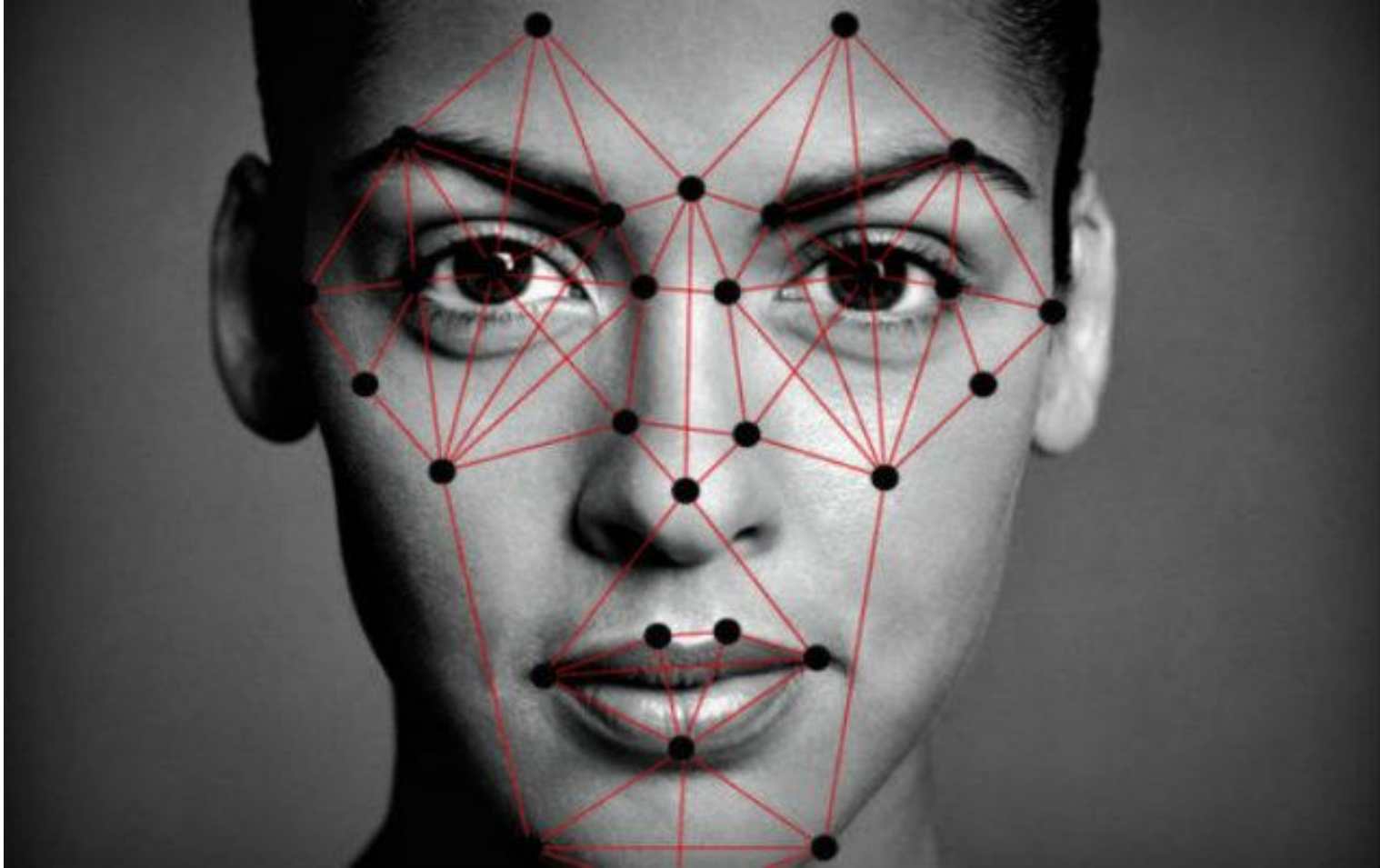
## Creating a digital signature



## Analytical Digitization



# Parsing faces and the creation of “Eigenfaces”



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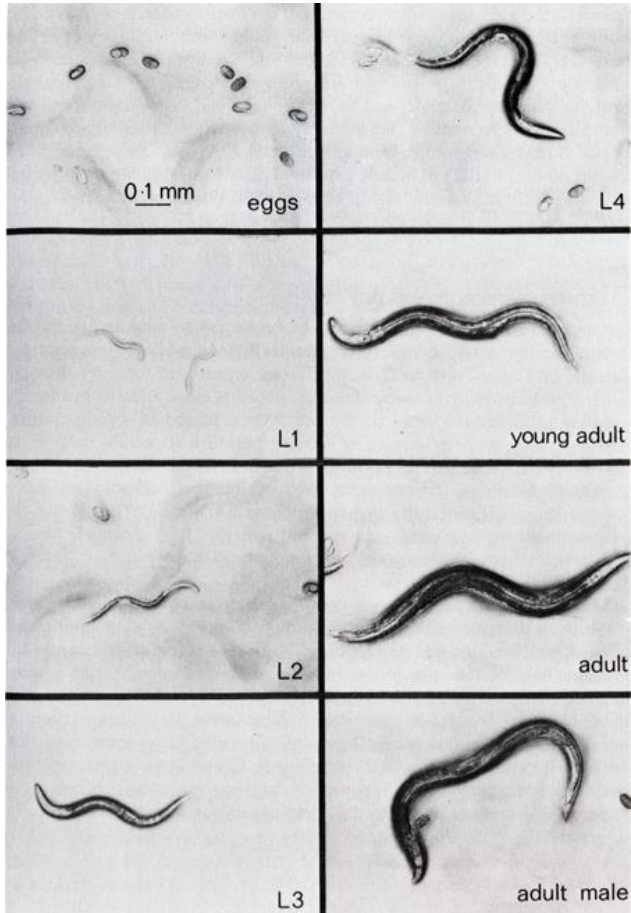
# We need to build “eigenplant” models



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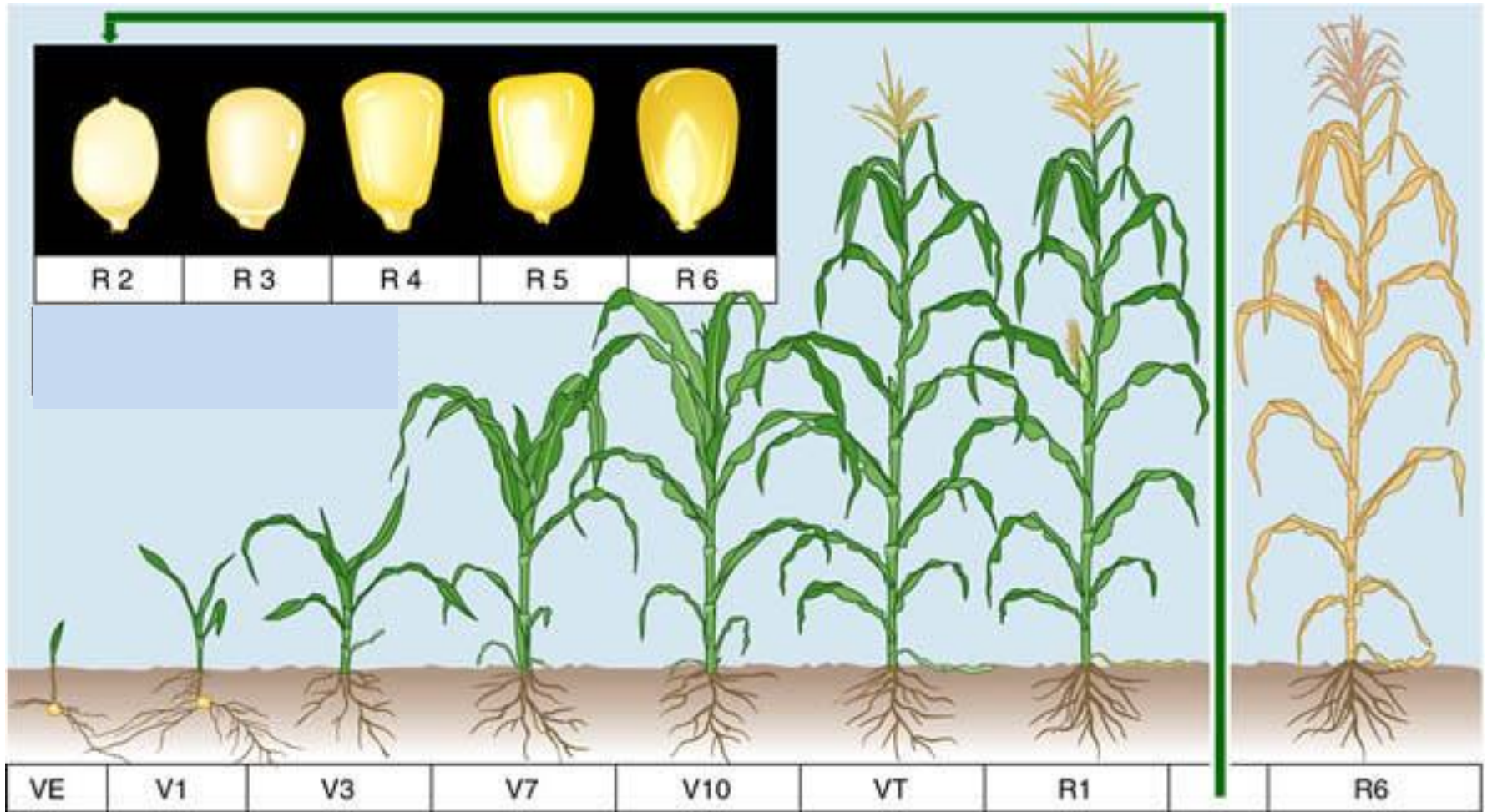
# Phenotyping (trait mapping) complex organisms



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# Corn developmental stages

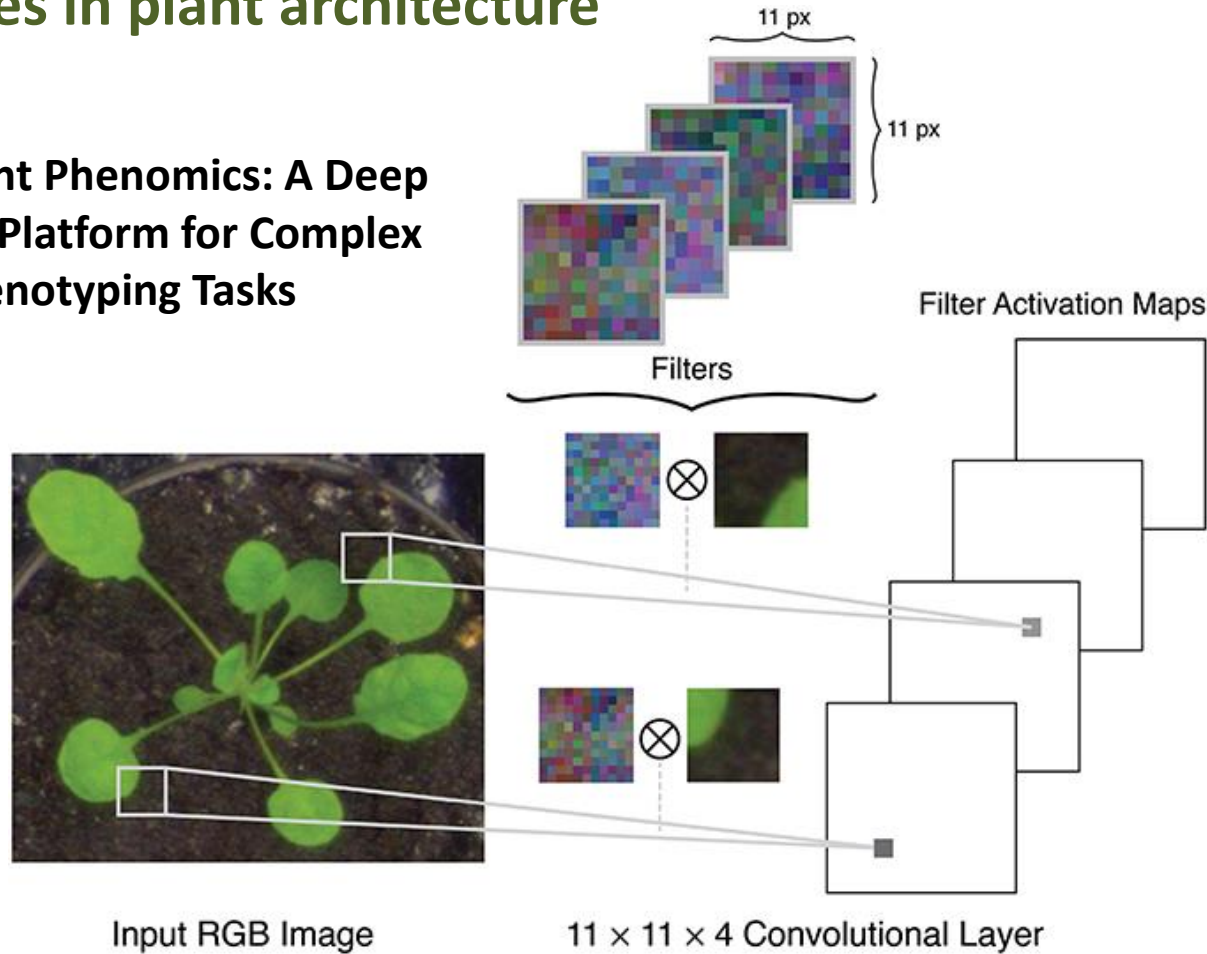


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# Deep learning techniques are being used to recognize subtle differences in plant architecture

## Deep Plant Phenomics: A Deep Learning Platform for Complex Plant Phenotyping Tasks



Ubbens and Stavness Univ of Saskatchewan

Front. Plant Sci., 07 July 2017 | <https://doi.org/10.3389/fpls.2017.01190>



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**Field-level data are now generating  
datasets of G x E x M**

**(genetics x environment x management)**



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# Image Acquisition Infrastructure



DRAGANFLY X4 – P  
(12-15 min flight time)



DRAGANFLY COMMANDER  
(20-25 min flight time)

# Field Based Data Acquisition

## RGB – RX100M3

Altitude (m)	Resolution (mm)
15	4.1
30	8.2
45	12.3
60	16.4

## REDEGE

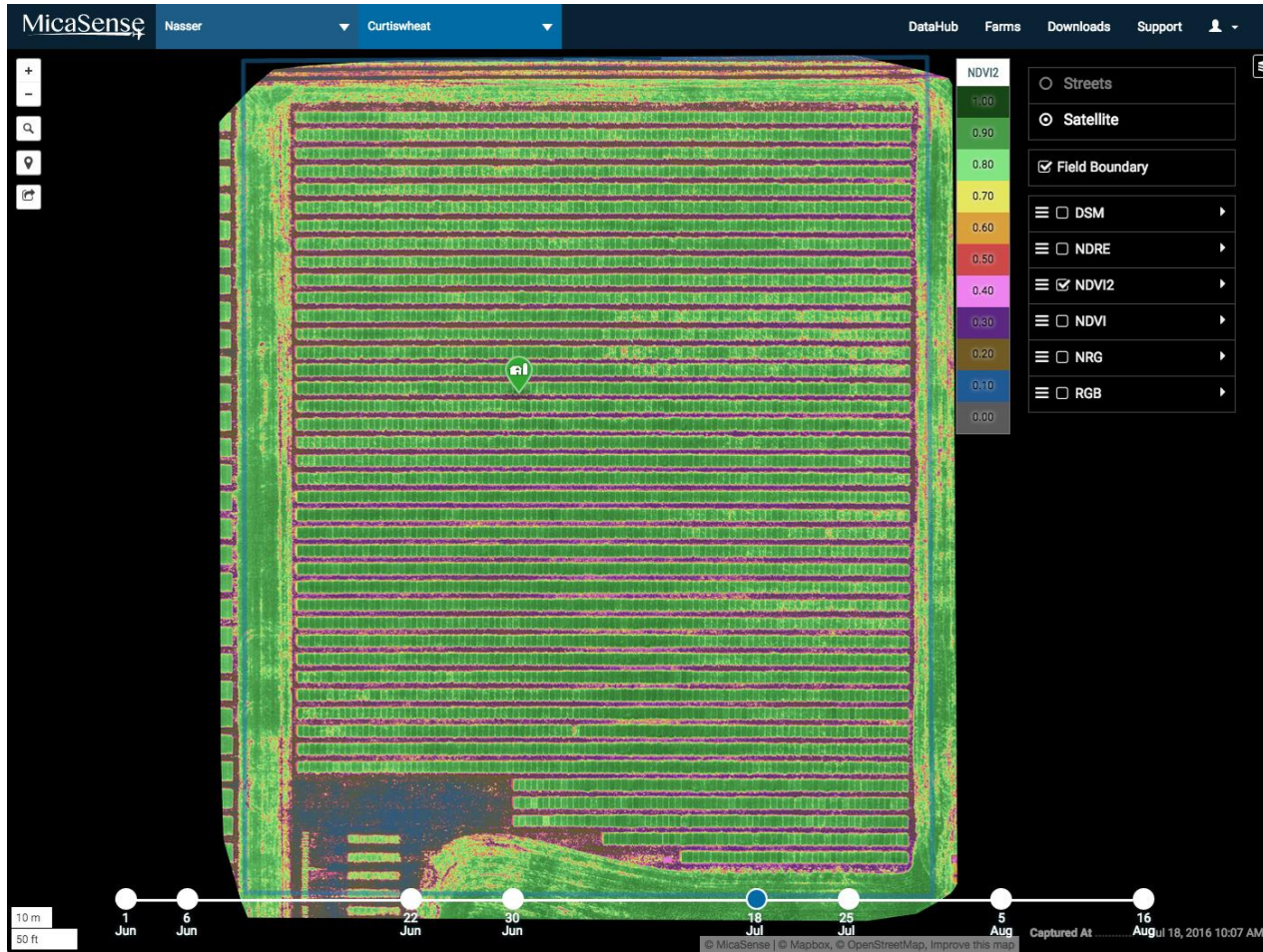
Altitude (m)	Resolution (mm)
15	13.4
30	26.8
45	40.2
60	53.6



- Flights – 30m
- Sub cm resolution

# Field scale data: durum wheat lines

## ~4000 plots, July 18



- Time course – resolution in time is an important metric
- Need to optimize temporal, spatial and spectral resolution

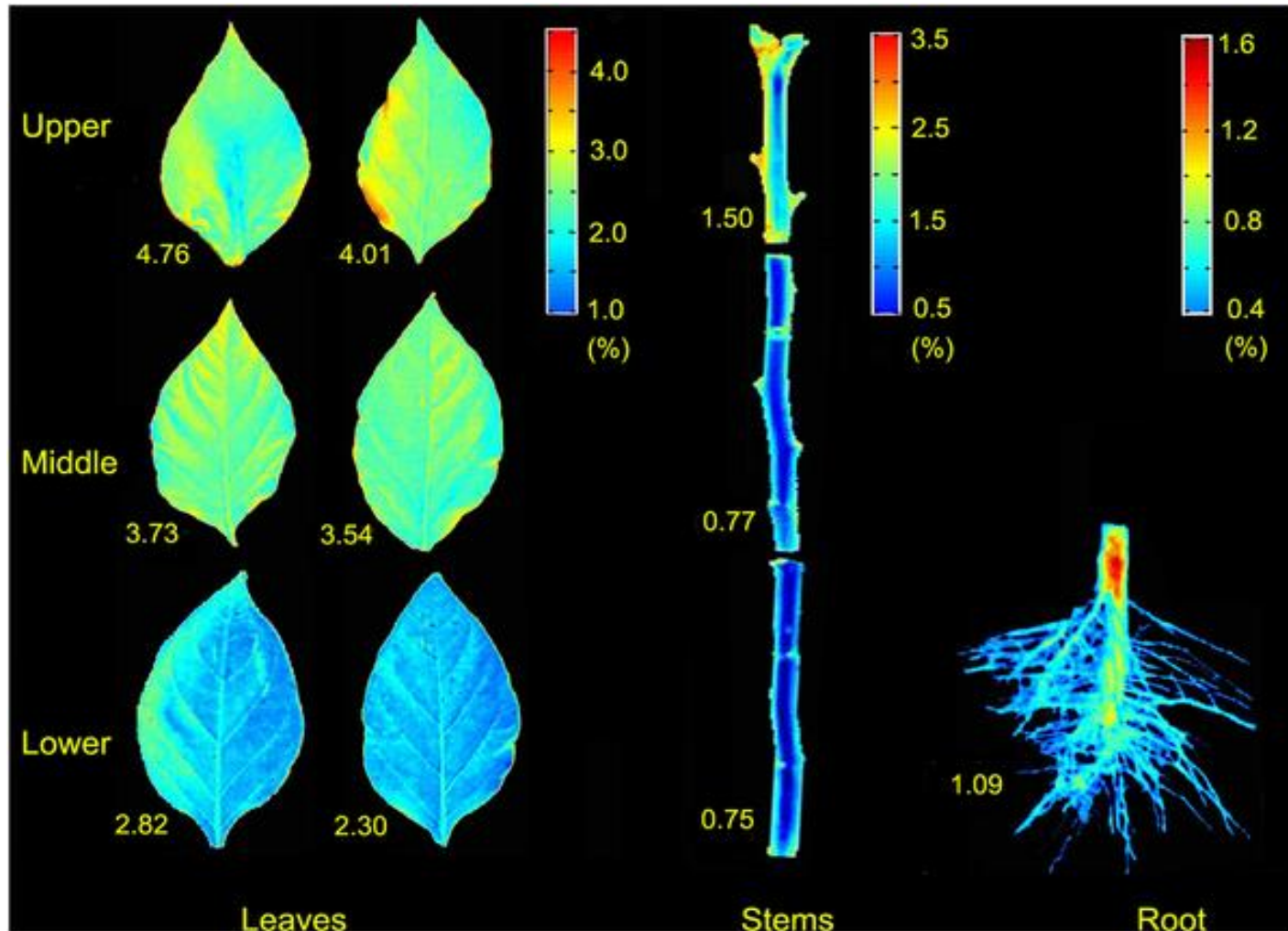
# Field level image acquisition up close



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# Hyperspectral imaging can reveal nutrient status of plants in vivo



Yu KQ, Zhao YR, Li XL, Shao YN, Liu F, et al. (2014) Hyperspectral Imaging for Mapping of Total Nitrogen Spatial Distribution in Pepper Plant. PLOS ONE 9(12): e116205. <https://doi.org/10.1371/journal.pone.0116205>  
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0116205>

**Big Data approaches are now being used  
along the food supply and value chain**



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# Big Data approaches are now being used along the food supply and value chain

## The Daily Telegraph

Thursday, February 14, 2013

19941

telegraph.co.uk

No 49,055 £1.20

# Horse meat scandal 'breathtaking'

### Beef products contaminated as a result of criminal activity may pose a risk to human health, MPs warn for first time

By Steven Swinhart, Gordon Rayner and Christopher Hope

THE full scale of the horse meat scandal is "breathtaking" and may pose a danger to public health, MPs warn today.

David Cameron's previous claims that the scandal was merely a "brand labelling" issue will be challenged by a report which says that more revelations are to come.

Having earlier told MPs in the Commons that beef was safe, the Prime Minister again battles yesterday by eating a beef pie and a pork pie in front of photographers at a reception in Westminster Hall.

But in their report today, the MPs on the environment select committee say it is "unacceptable" that crim-

inals who are prepared to pass off horse meat as beef go following good hygiene standards.

In other developments yesterday, Owen Paterson, the Environment Secretary, said that consumers had fallen victim to an "intentional 'brand labelling' conspiracy".

Leland warned that the meat of hundreds of horses slaughtered in British abattoirs may have been contaminated with a cancer-causing gene killer.

It emerged that a Dutch trader involved in the supply of meat used in French language ready meals had previously been jailed for passing off Argentine horse meat as beef.

A Welsh meat processing plant was ruled by a second time by the Food Standards Agency after the

Daily Telegraph discovered that meat had been "swapped" off the premises.

It emerged that two major British companies have been investigated as part of the horse food scandal.

The FSA is preparing to announce the results of tests for iohexol, a veterinary drug, in horses killed in British slaughterhouses.

The drug, which is used to treat food chain because it has been linked to cancer. Tests have so far found no evidence of the drug in contaminated meat sold in British supermarkets. However, the environment select committee raised concerns about the wider health implications of the illegal trade.

The report cites evidence from the UK-based Institute of Environ-



Beef and red Veal are safe. Enjoy your burger. Watch out for the Beef

mental Health which warned that "supermarkets may 'exchange' food".

The MPs said: "We agree, it seems improbable that individuals need directly see applying the high hygiene standards rightly imposed in the food production industry."

Rory Caplan, a Labour member of the select committee, said: "If people are prepared to lie to you about what's in your food then you can have no confidence they are not putting other stuff in it as well."

"These people are criminals, they could be putting anything in there. When there's been a total failure of the food security system you can have no trust in the food." The European Commission announced

yesterday that thousands more DNA tests on meat products are to be carried out by member states.

Experts warned that the cost of the increased surveillance and enforcement.

The MPs called for the FSA to be given statutory powers to order retailers to test their products.

Anne McInerch, the committee chairman, said: "The scale of contamination in the meat supply chain is breathtaking. More revelations will doubtless come to light in the UK and across the EU."

"There is every indication that horse meat has been intentionally substituted for beef by criminals with access to the food industry. Horsemeat within the food industry

has duped consumers in the UK and across Europe in pursuit of profit."

The MPs conclude that the public have been "let down" by major retailers. They also warn the scandal will be unable to completely limit the distribution of horsemeat until the FSA "is seen to guarantee made in haste", the MPs say.

Mr Paterson later might attacked a European demand to focus how to tackle the problem.

He said: "This is a criminal conspiracy to defraud the public. At the beginning of the week we talked about incompetence, it looks as if it has gone beyond incompetence, it now looks as if it is criminal." *Continued on Page 7*



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# FOOD FRAUD

Food fraud occurs when products are deliberately:

 <p>Diluted</p>	 <p>Mislabeled or misrepresented</p>	 <p>Tampered with</p>	 <p>Substituted with another product</p>
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 <p>Profit</p>	 <p>Cheap and/or easy to copy</p>	 <p>Unsatisfied market demands</p>	 <p>Difficulties in detection and proof</p>
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The cost of food fraud:

 <p>Fraud costs the UK food &amp; drinks industry £11bn per year</p>	 <p>Fraud contributes 5p to the price of a £1 loaf of bread...</p>	 <p>...and 16p to the cost of a pint of beer</p>	 <p>Fraud costs consumers £424 per household per year</p>
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Fraud costs legitimate food retailers **up to USD 15 billion a year\***

\* Grocery Manufacturers Association

**Fraudulent food businesses don't meet standards ISO 22000 (food safety)**



# Big Data and the Food supply and value chain

