Machine learning in plant science and plant breeding

Plant-RX matchmaking symposium, 24-2-2021

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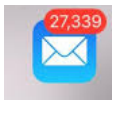
Data, data, data!

Activity	#per day
Photos and videos shared on Instagram	95 million
Tweets sent	500 million
Google search queries	3.5 billion
Emails sent	300 billion



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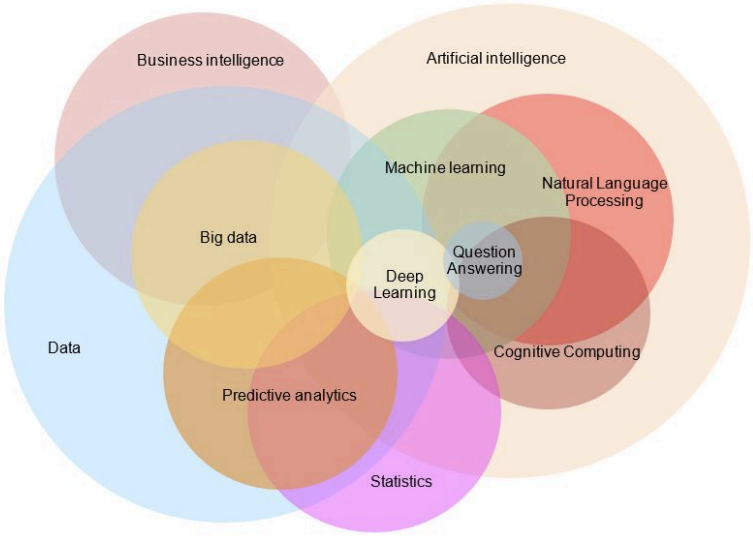
Techjury.net

2

Data-driven opportunities



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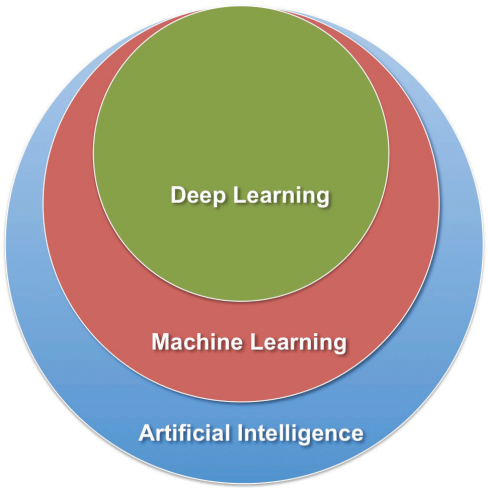
3

Machine learning and artificial intelligence



- Coming together of
  - cheap sensors
  - massive data storage
  - cheap compute power
  - pervasive computing
  - internet
  - social media

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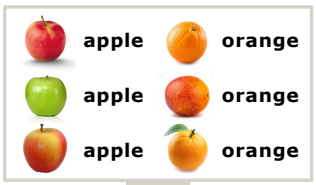
Machine learning

- Learn from data to solve problems too complex to model



apple

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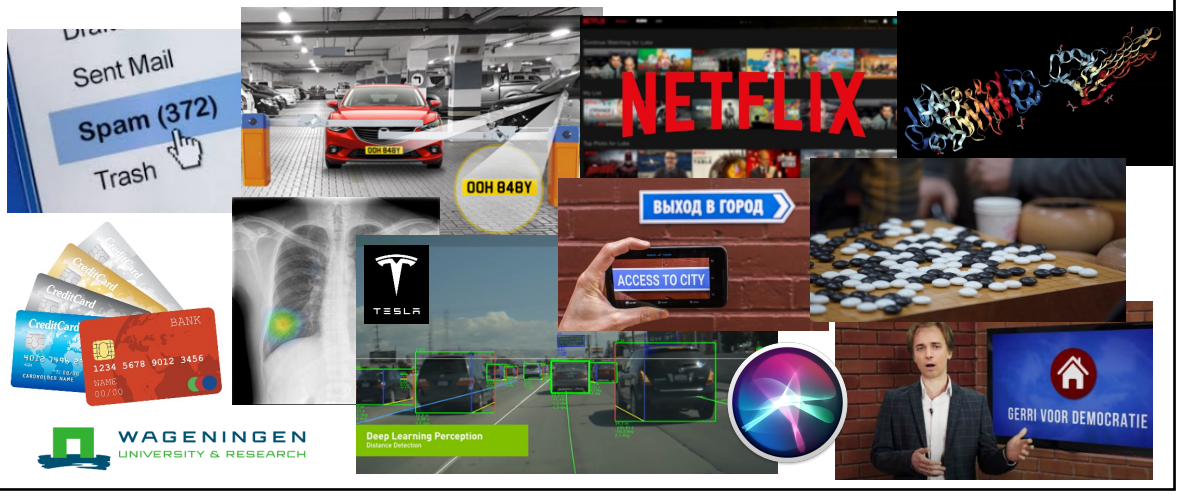
Machine learning

- Learn from data to solve problems too complex to model



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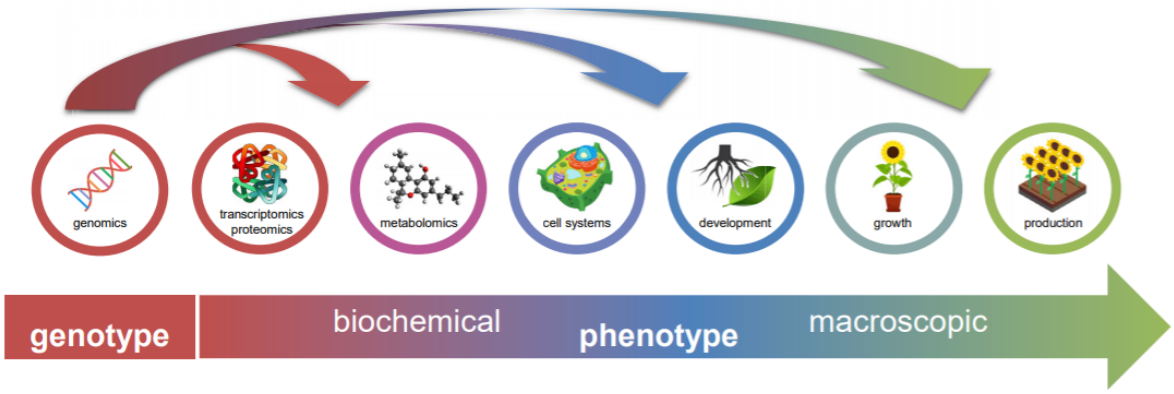
Various levels of biological organization

- Machine learning to analyse and integrate data



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Van Dijk *et al.*, *iScience* 2021

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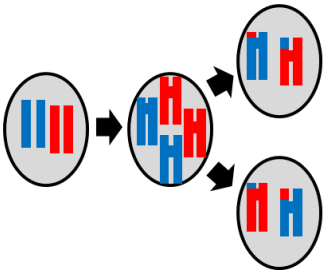
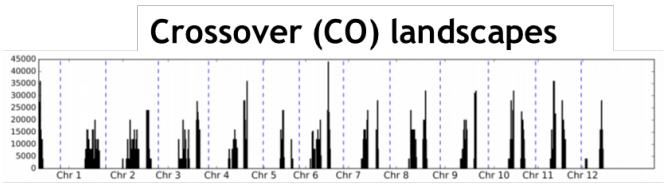
Example #1: Crossover prediction





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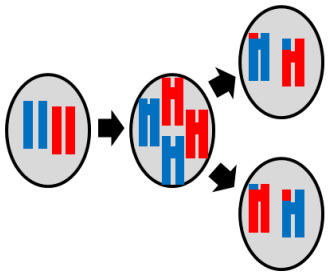
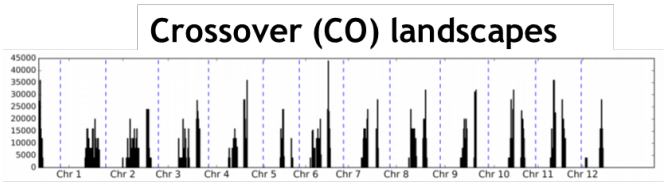
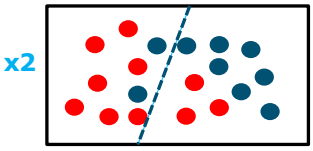
Example #1: Crossover prediction





Learn to predict **CO sites** vs **non-CO sites**



features, representing
a given genome region

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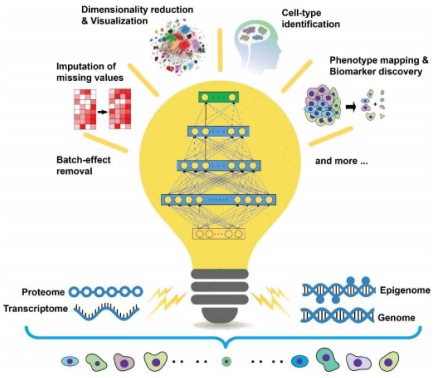
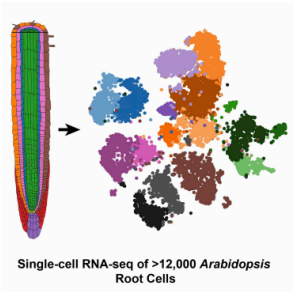
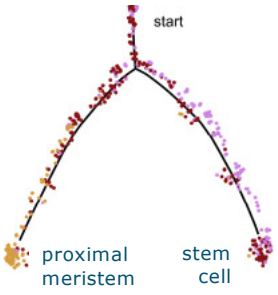
Demirci et al., Plant Journal 2018

Example #2: Single-cell sequencing

- Machine learning to integrate heterogeneous data







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Shulse *et al.*, *Cell Reports* 2019
Zhang *et al.*, *Mol Plant* 2019

Challenge: engineering vs. science

understanding
interpretability

complexity
performance

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neuralnetworksandeeplearning.com

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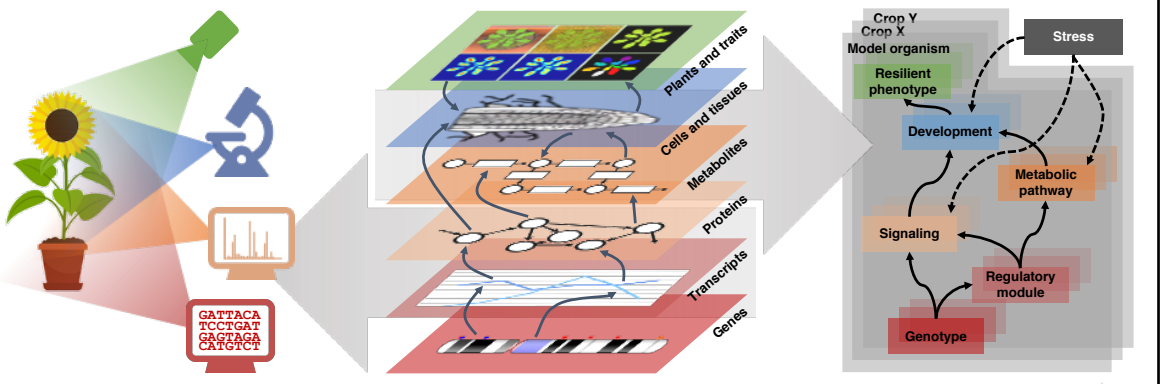
From black-box to mechanistic models

Plant-RX



experiment data information knowledge understanding

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