

Deep Learning in Agriculture - what's happening

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TECHNOLOGY

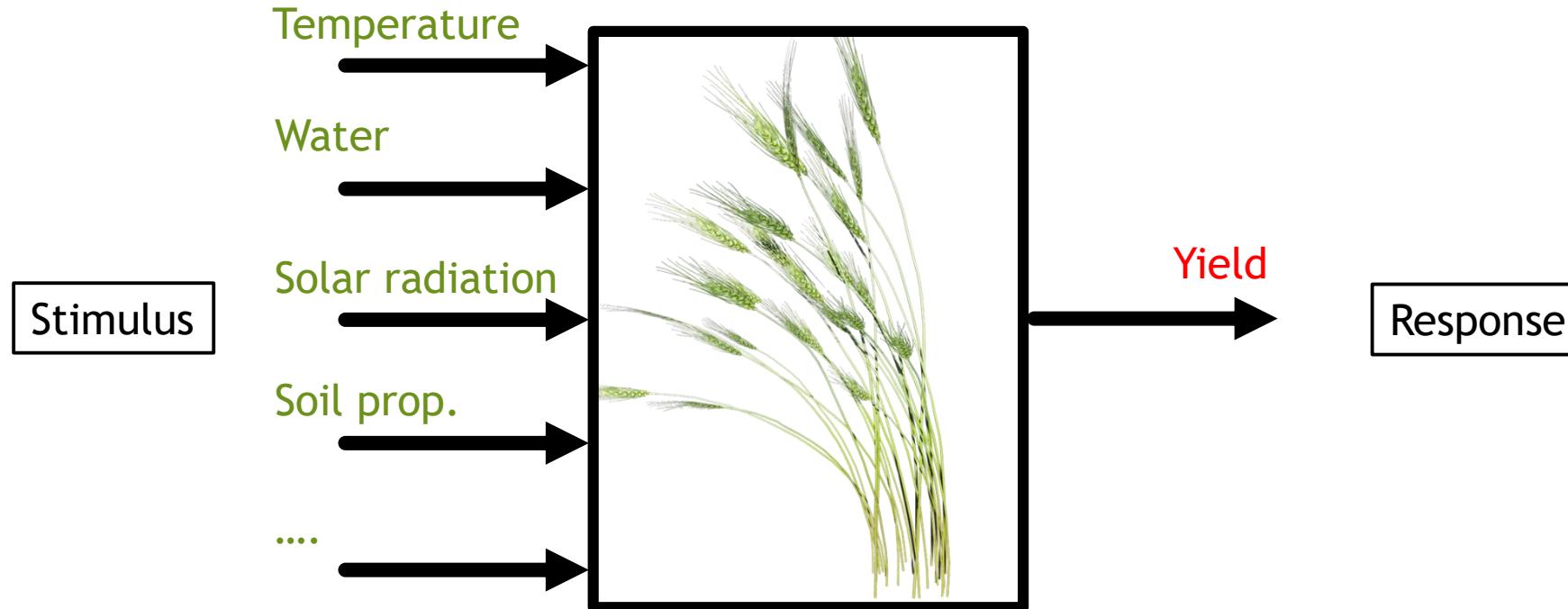


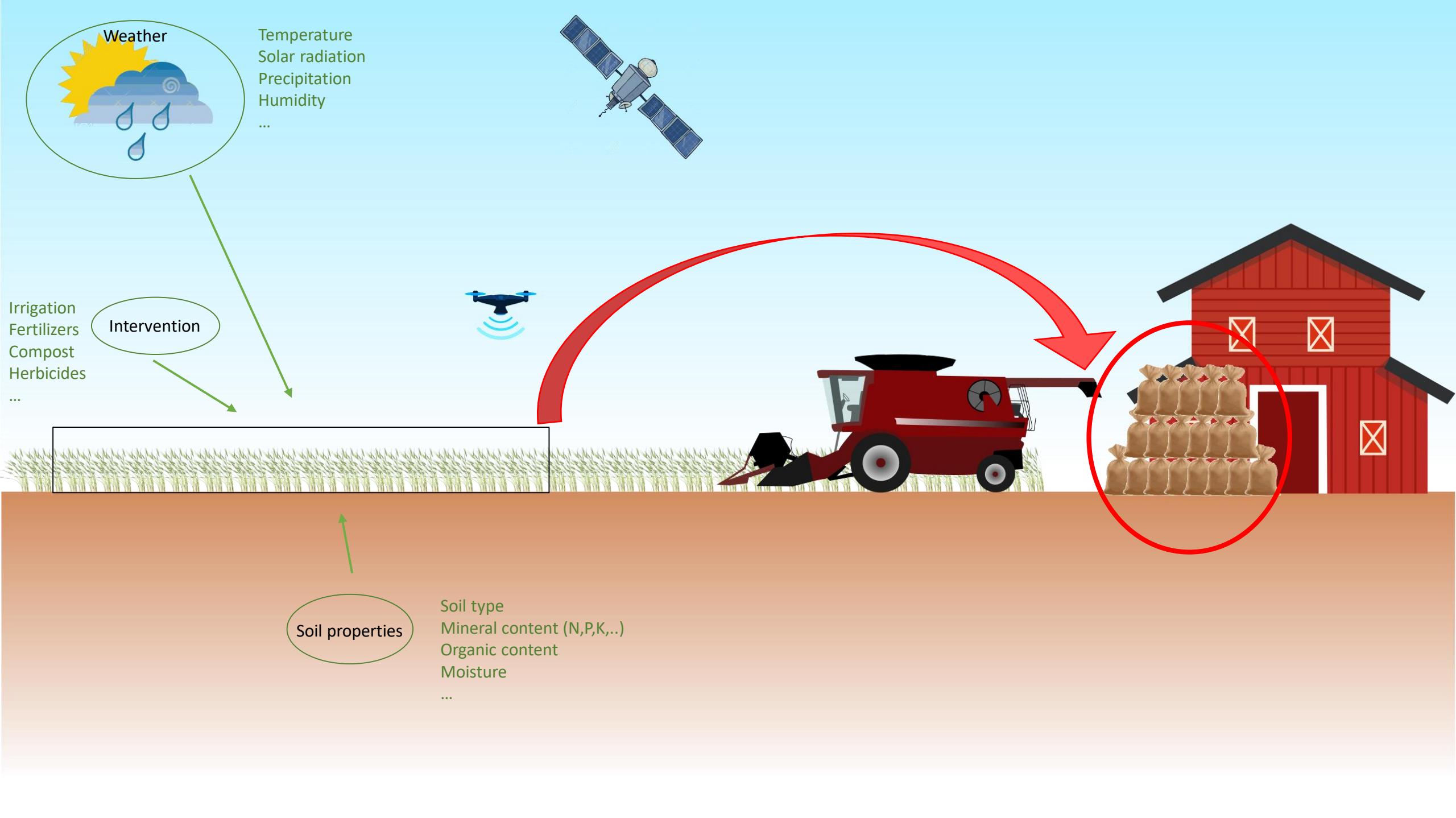
The European Agricultural Fund
for Rural Development:
Europe investing in rural areas

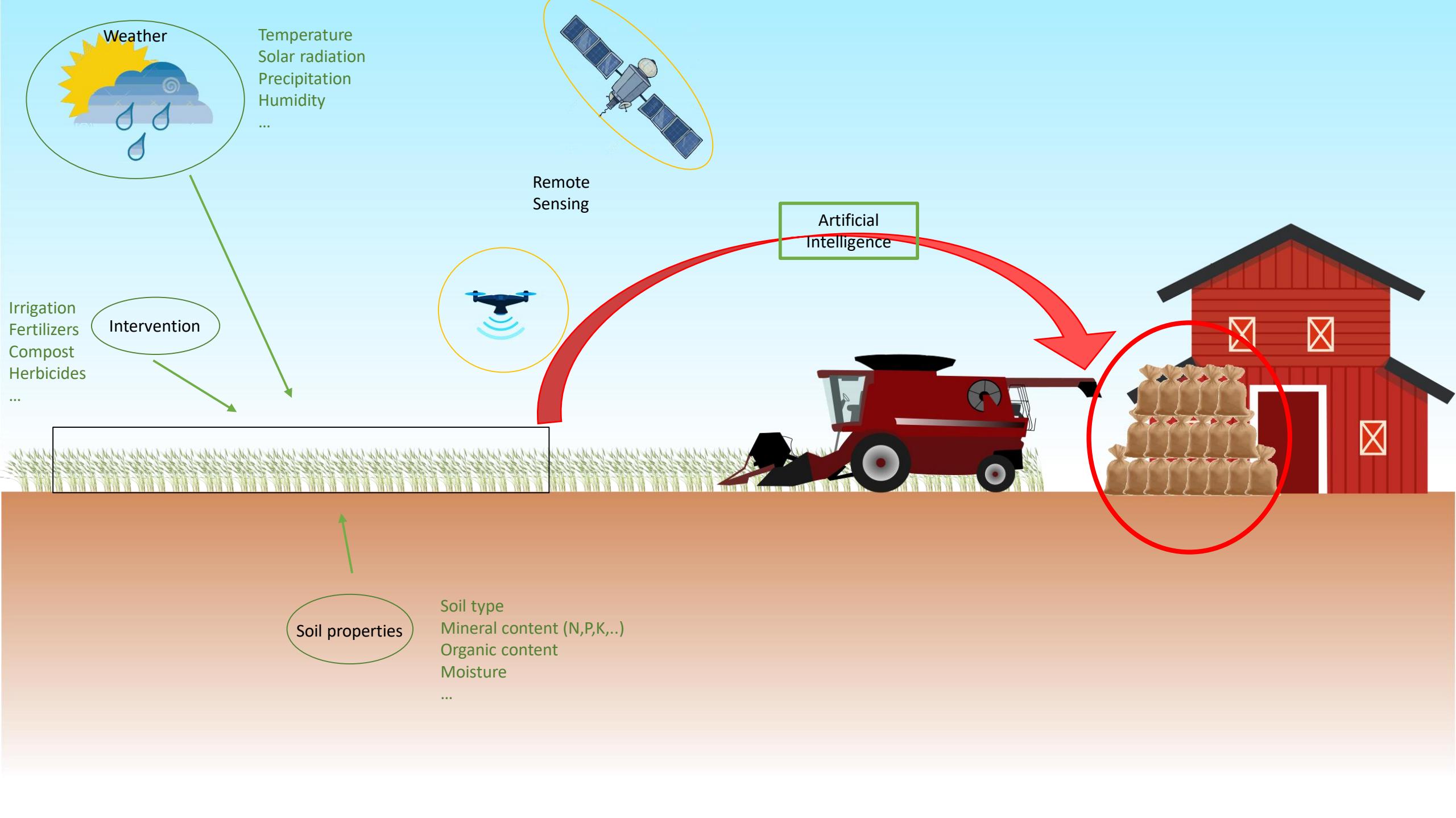
System of input and output: simplified

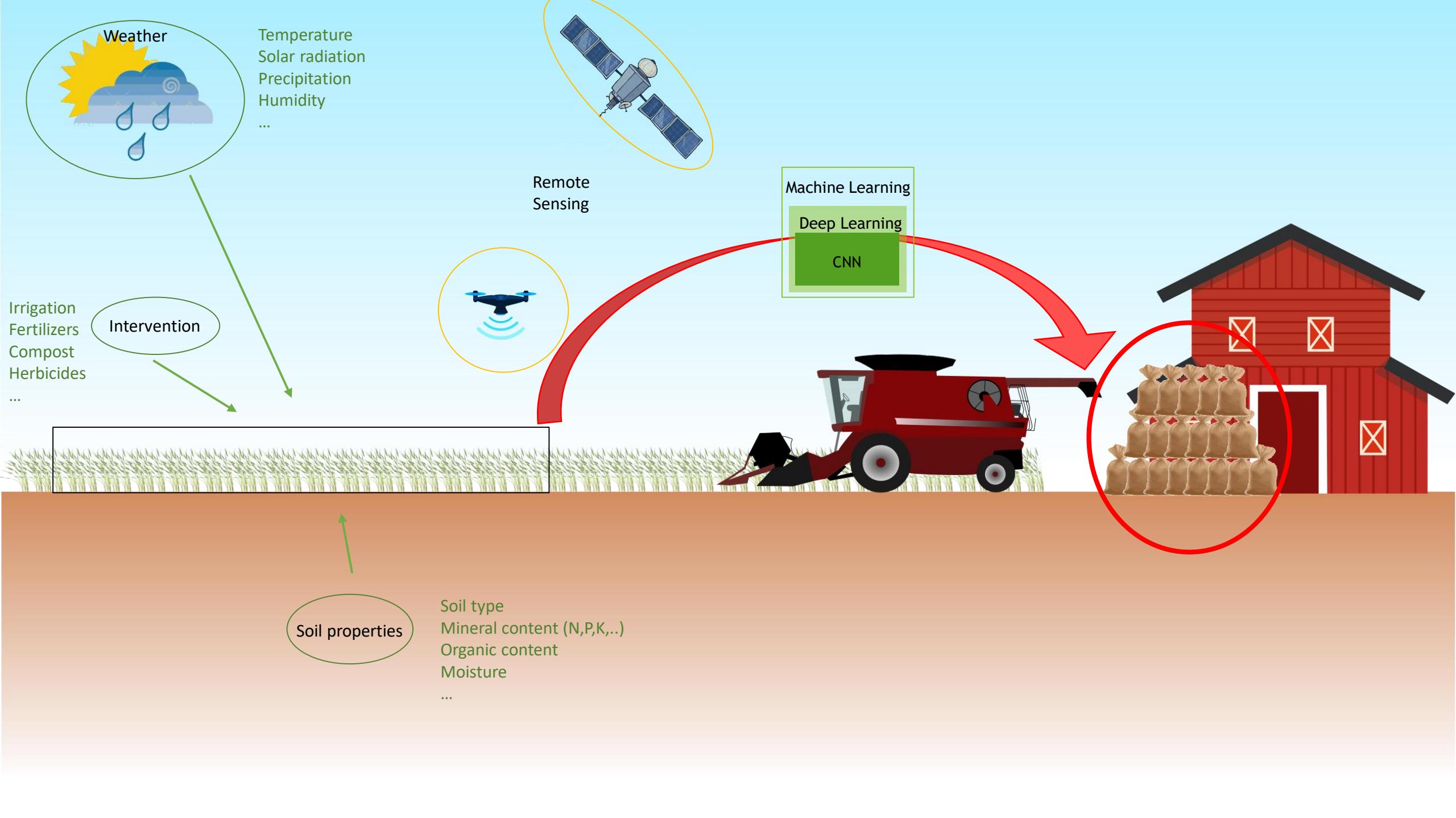


System of input and output: simplified

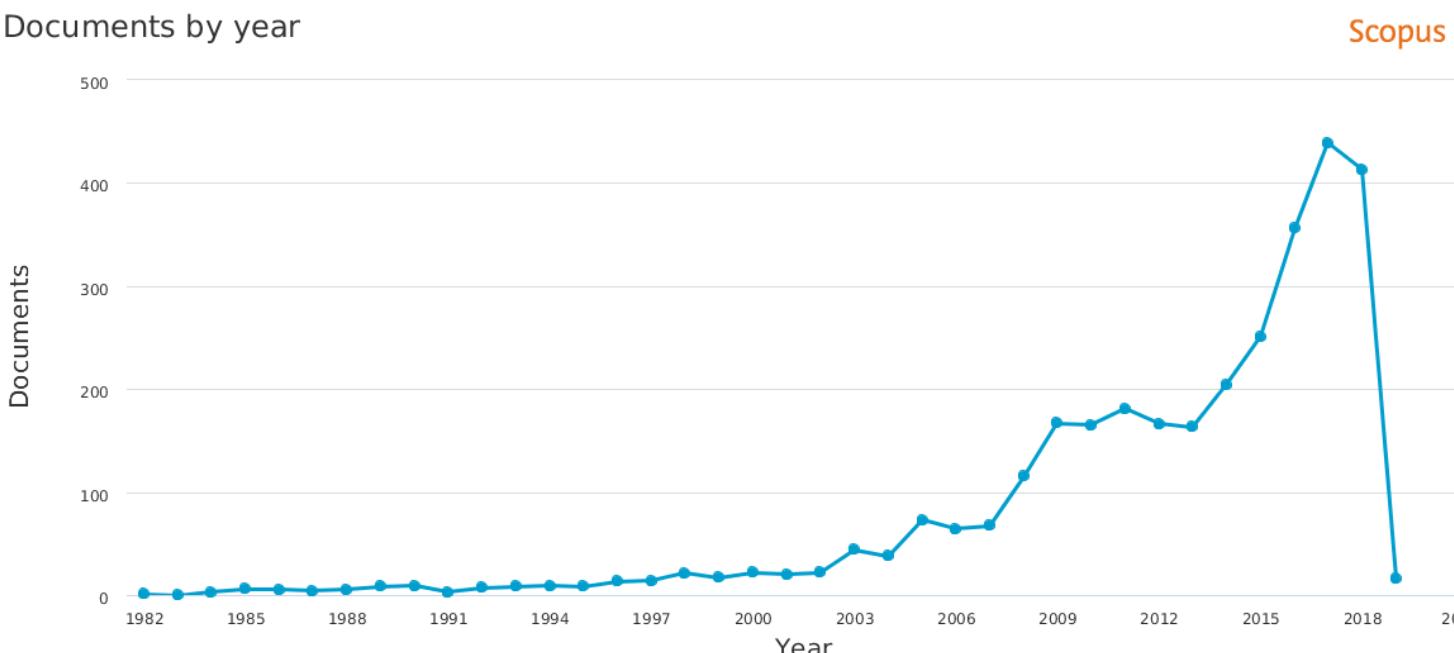
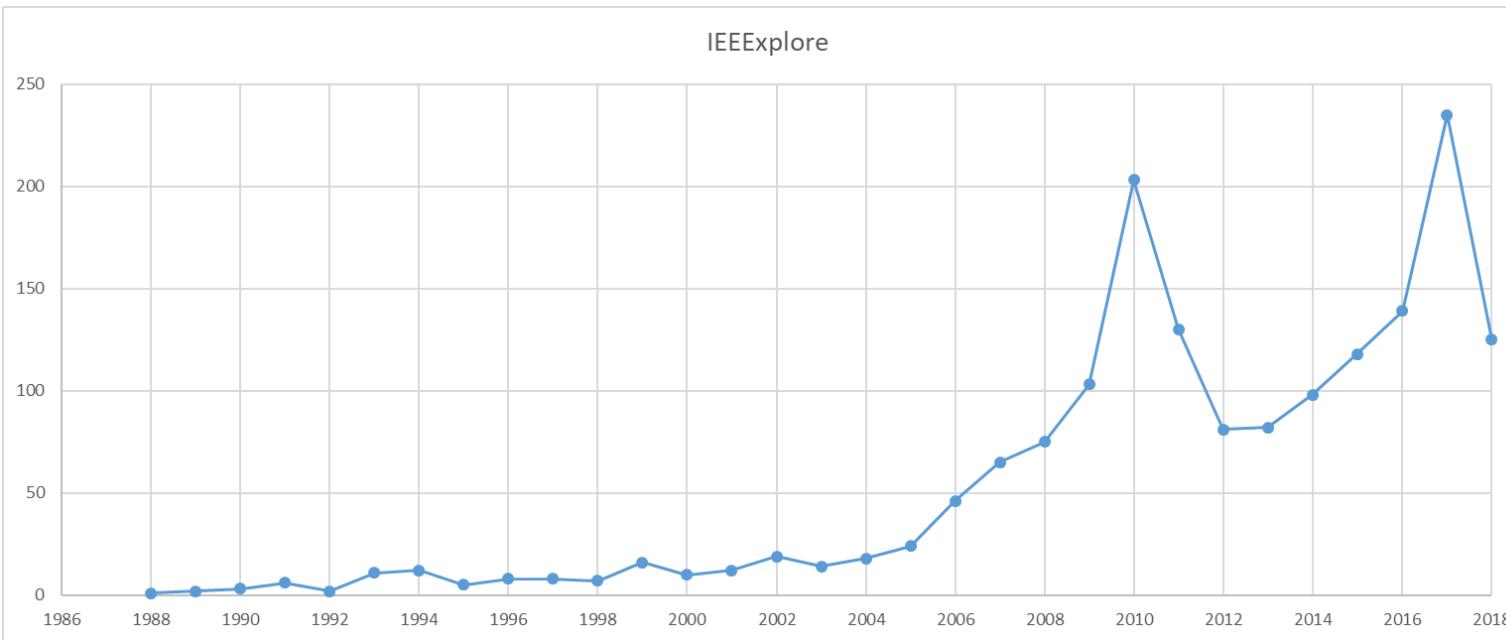








("machine learning" OR "deep learning" OR "artificial intelligence" OR "neural network") AND ("agriculture")



Sensor Data → Artificial Intelligence Methods → Agronomy

Temperature
Solar radiation
Precipitation
Humidity
...

Irrigation
Fertilizers
Compost
Herbicides
...

Soil type
Mineral content (N,P,K,...)
Organic content
Moisture
...

+

Remote sensing
image data

Machine Learning

Deep Learning

CNN
(Convolutional
Neural Networks)

Agriculture information processing

Agriculture production system optimal control

Smart agriculture machinery equipment

Agricultural economic system management

Sensor Data → Artificial Intelligence Methods → Subject areas

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image data

Machine Learning

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Plant

Animal

Land

Mechanization

Sensor Data

Artificial Intelligence Methods

Subject areas

Temperature
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Remote sensing
image data

- Hyperspectral
- Multi-spectral
- SAR
- Infrared/Thermal
- LIDAR
- NIR
- Optical
- X-ray

Machine Learning

Deep Learning

CNN
(Convolutional
Neural Networks)

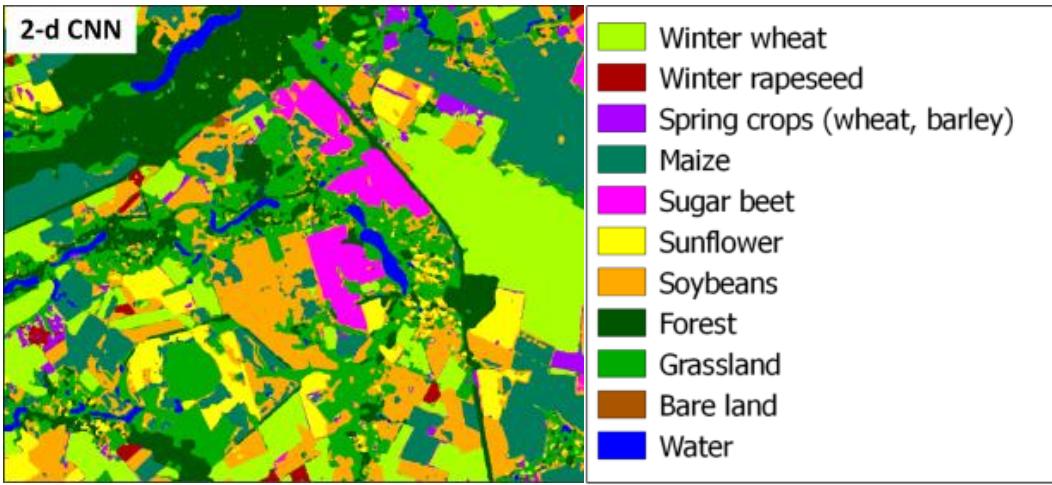
Plant

Animal

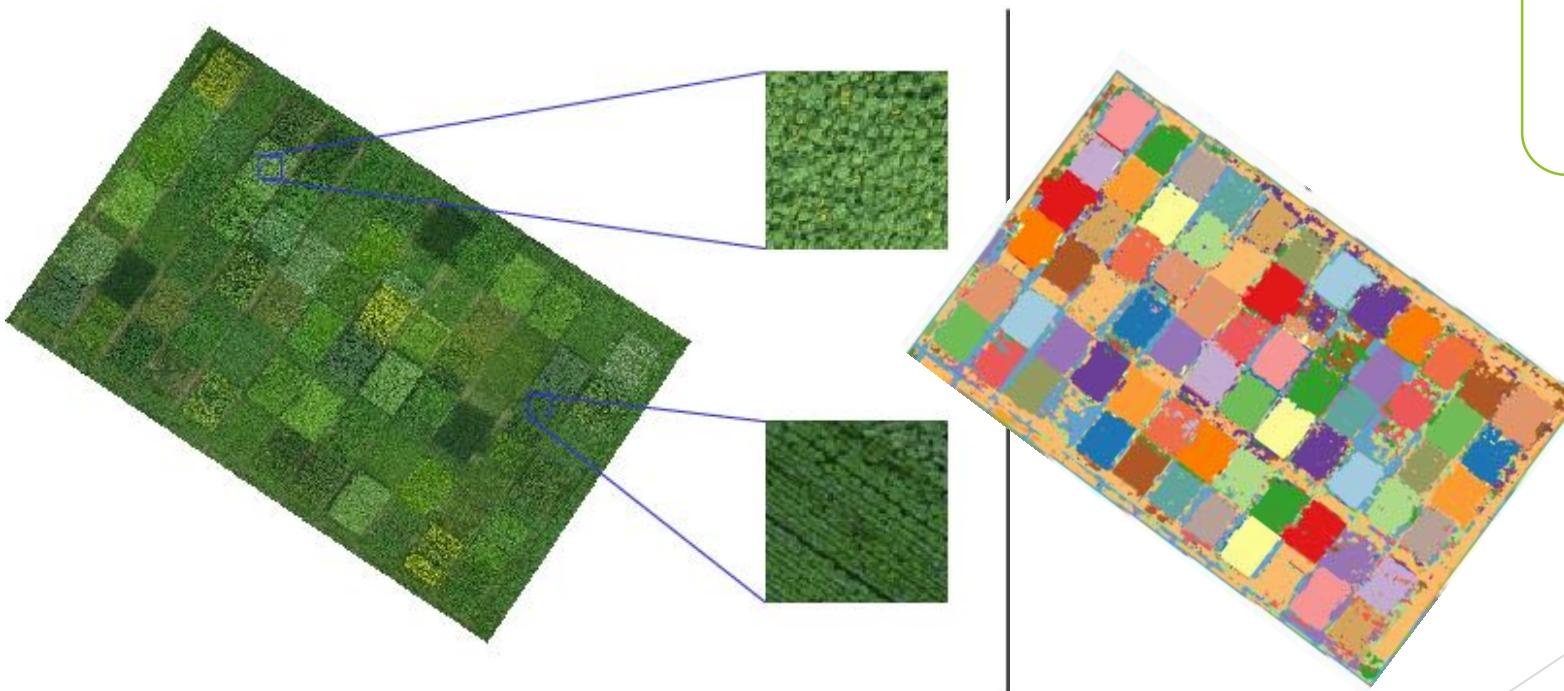
Land

Mech.

- Crop classification
- Phenology recogn.
- Disease detection
- Weed/pest detection
- Fruit counting
- Yield prediction



Kussul et al. 2017; DOI: 10.1109/JSTARS.2016.2560141



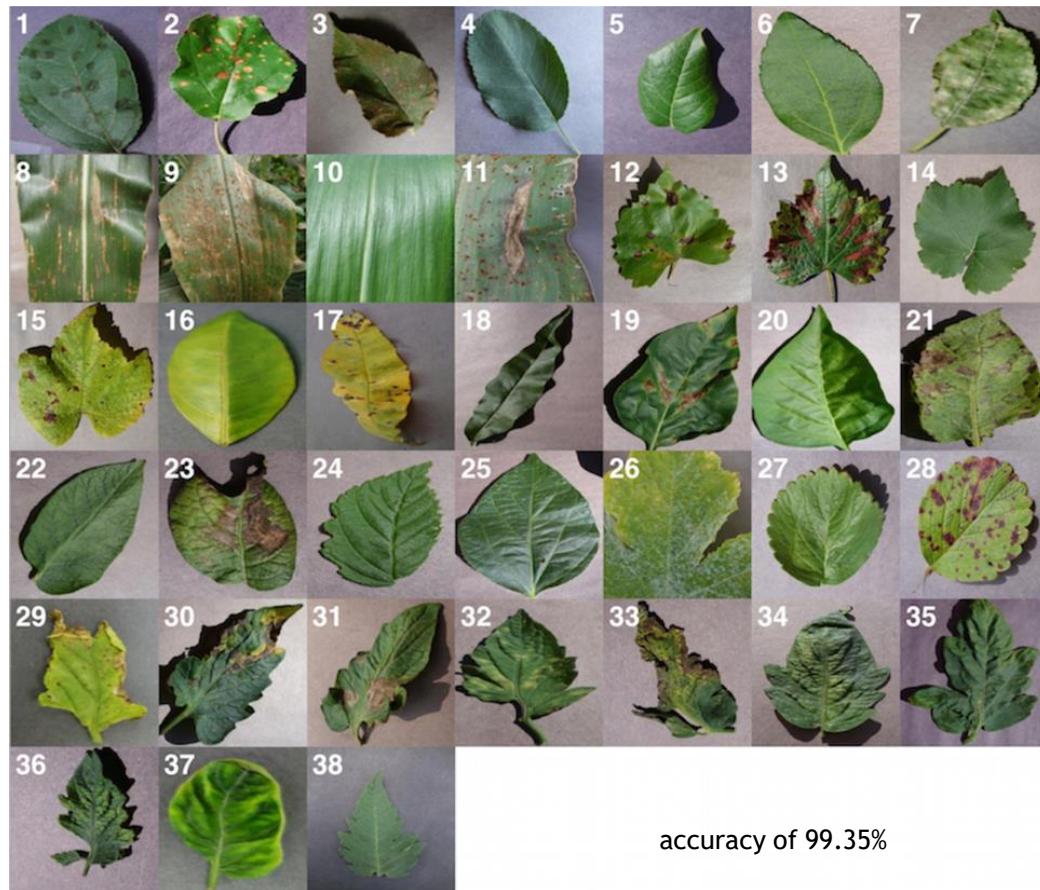
Rebetez et al. 2016; ISBN: 978-287587027-8

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Dataset	Method	Precision (%)	Recall (%)	F1-Score (%)	Accuracy (%)
Cotton	CNN-BA	87.32	86.14	86.58	86.54
Pepper	CNN-BA	88.12	87.24	87.28	87.14
Corn	CNN-BA	87.32	86.14	86.58	86.54

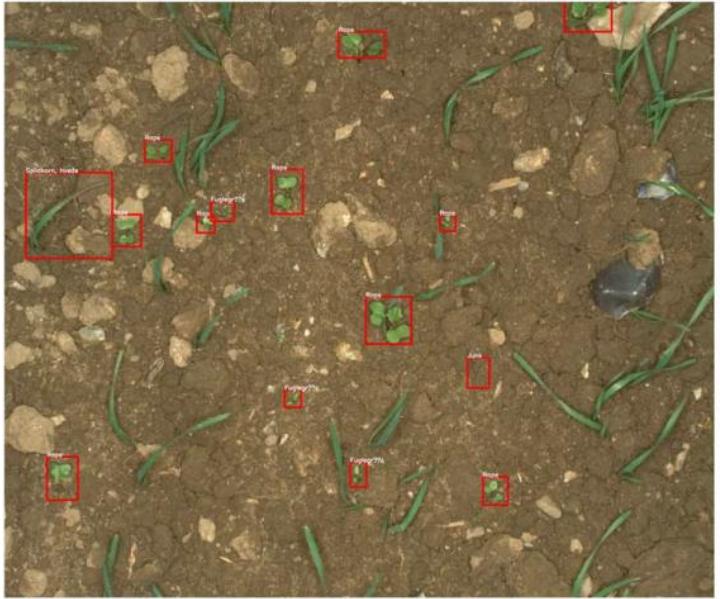
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accuracy of 99.35%

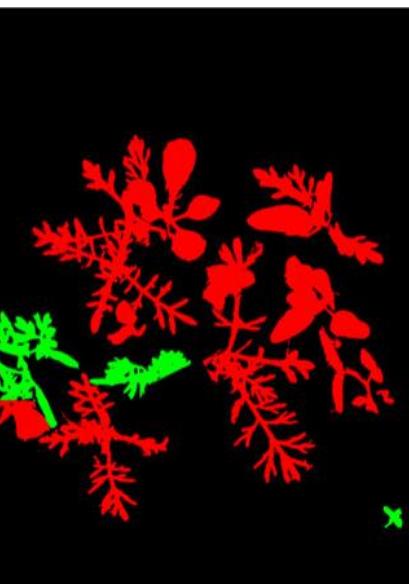
Mohanty et al. 2016; DOI: 10.3389/fpls.2016.01419

- Crop classification
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- **Disease detection**
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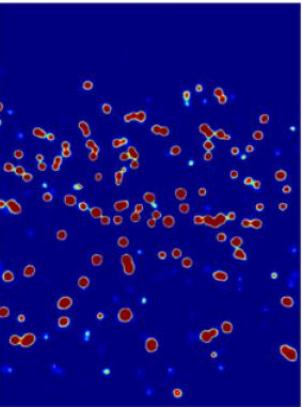
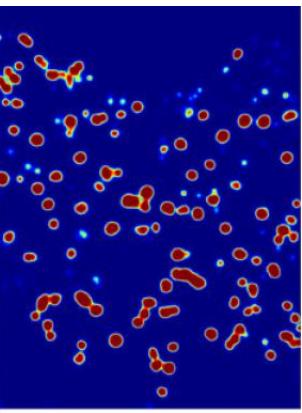


Dyrmann et al. 2017; DOI: 10.1017/S2040470017000206

- Crop classification
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McCool et al. 2017; DOI: 10.1109/LRA.2017.2667039



Chen et al. 2017; DOI: 10.1109/LRA.2017.2651944

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What next?

- ▶ “...one key shortcoming: no major company has really delivered on the promise of facilitating better in-season decision-making.” (Barclay Rogers, agfundernews, Sep 2018)
- ▶ The next big wave in agtech will be better in-season decision-making, including:
 - ▶ Directing resource allocation based upon on actual field performance
 - ▶ Informing in-season fertilizer applications
 - ▶ Detecting pest and disease pressure
 - ▶ Evaluating product performance
 - ▶ Guiding irrigation decisions
 - ▶ Forecasting field-level yields ←
 - ▶ Providing better management zones

Future?

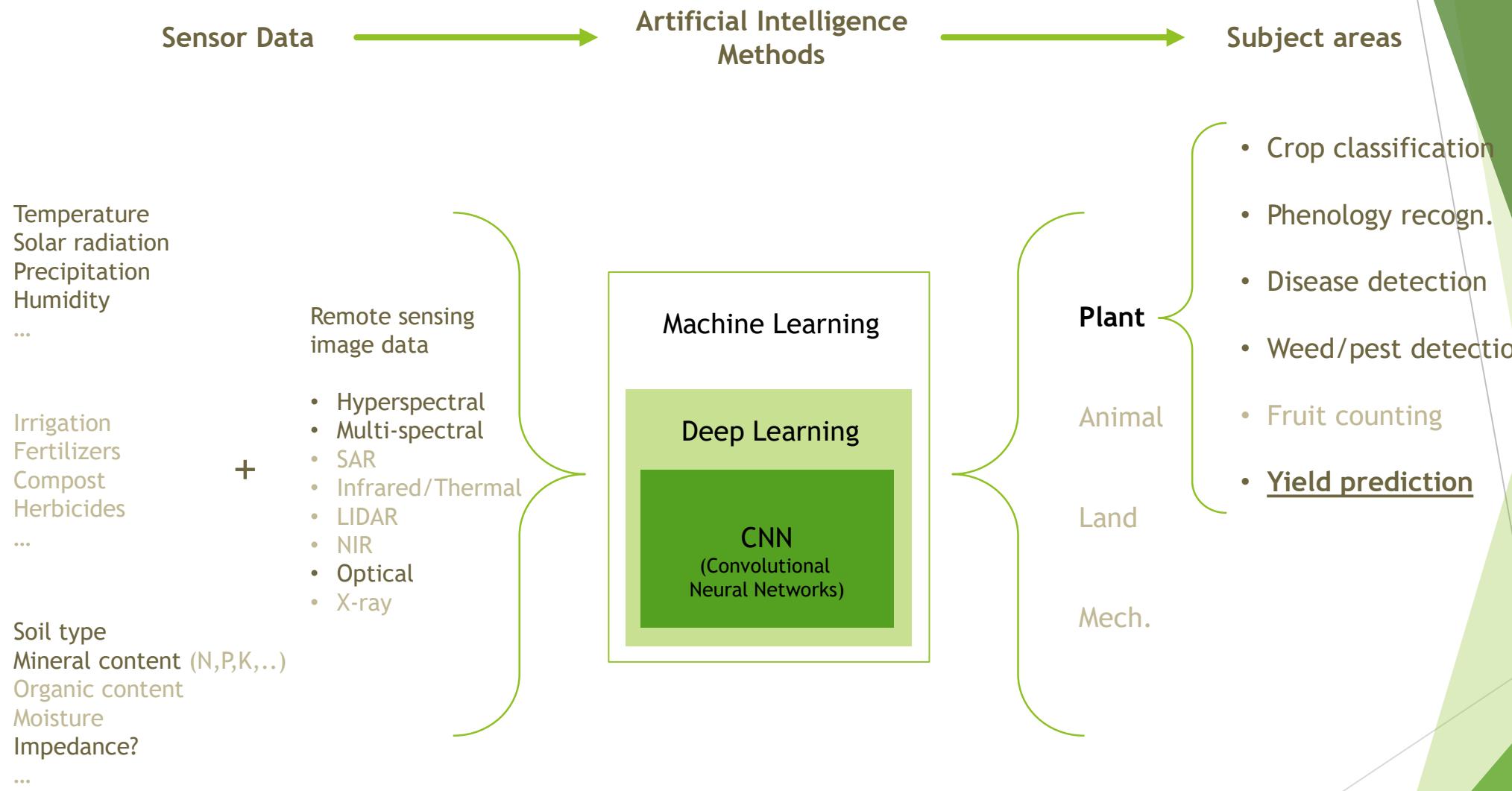
- ▶ Hyperspectral imaging : greater source of data for analysis
- ▶ Drone tech
- ▶ Crop models: AI methods
- ▶ Databases and decision making?



<https://agfundernews.com/growing-impact-hyperspectral-imagery-agrifood-tech.html/>

VTT creates the world's first hyperspectral iPhone camera

<https://phys.org/news/2016-11-vtt-world-hyperspectral-iphone-camera.html>



MIKÄ-DATA context