Yield Estimation

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Yield estimation models (for a wide variety of crops) are among the key priorities of the global agricultural insurance sector, as insuring yield may be referred as all-peril crop insurance. Existing pilot models continue their development while service providers are calibrating yield estimation models with in-situ data applying machine-learning and other technologies (e.g.: rice (Philippines, Indonesia, China)).

Combination of other EO services (e.g. field delineation, crop identification, NDVI, etc.) with yield estimation models provides a broad range of applications in all agricultural insurance business processes and product cycle activities. Being important at all product cycle stages, it is highly important for a more robust underwriting and loss adjustment processes.

PRODUCT SPECIFICATIONS

Main processing steps

Yield estimation is generally based on either machine learning (e.g. deep learning) and/or process-based (i.e. crop growth models) modeling approaches. Both can make use of a range of input data sources including satellite imagery time-series (e.g. of vegetation indices and derived parameters e.g. emergence date) and meteorological data along with environmental parameters such as soil and crop type. Process based models also allow different scenarios to be simulated, e.g. with or without water- or nutrient stress.

Input data sources

Optical: Sentinel-2

Radar: Sentinel-1

Supporting data: in-situ calibration data (yield statistics, crop cutting experiments...)

Spatial resolution and coverage

Spatial resolution: 10m

Coverage: Farm level till Watershed scale

Availability: globally available

Accuracy / constraints

Thematic accuracy: depending on region and availability of in situ data

Spatial accuracy: field level

Limitations

There are still no globally applicable yield forecasting models, mainly local pilots.

Frequency / timeliness

Frequency: daily

Timeliness: near real-time

Delivery / output format

Data type: yield estimates (ton/ha). GIS-ready data formats; regional summaries, statistics, report sheets; API (depending on customer needs)

File format: parcel level aggregated values (e.g. CSV)

Accessibility

Commercially available on demand from EO service providers.

CHALLENGES ADDRESSED - USE CASE(S)

Product Development:

- Index insurance: Risk / crop modelling (Correlation of EO data with in-situ data)
- Index insurance: Relation between weather events and impact on crop productivity
- Index insurance: Parcel/Field and regional yield statistics Elaboration of crop profile: Field crops, vegetables, horticulture, greenhouses

Underwriting:

- Seasonal portfolio monitoring
- · Online platforms or easy-to-use interfaces integrating various data sources (e.g. vegetation stress, field boundary changes, comparison, etc.)
- Risk / crop zoning
- Identification of vegetation stages (identify most sensitive stages when crop is the most vulnerable to a risk, e.g. flowering stages)

Loss Adjustment:

- Benchmark physical field observations against yield loss detection (e.g. product calibration)
- Benclificate projectar integration observations tages
 Risk-mapping against crop's vegetation stages
 Increase credibility of loss adjustment (e.g. show EO data/visualization to support loss adjustment communication to farmer)
 Enhance field survey (better precision with EO data support)
- Assess crop damage at field level
 Distinct field heterogeneity with crop damage

Claims Handling:

- Identification of actual damage size (tons (volume) / ha (area)
 Quality control assessment of claims before pay-out
- Fraud detection
- · Obtaining timely, reliable and consistent data to speed-up the indemnity pay-outs