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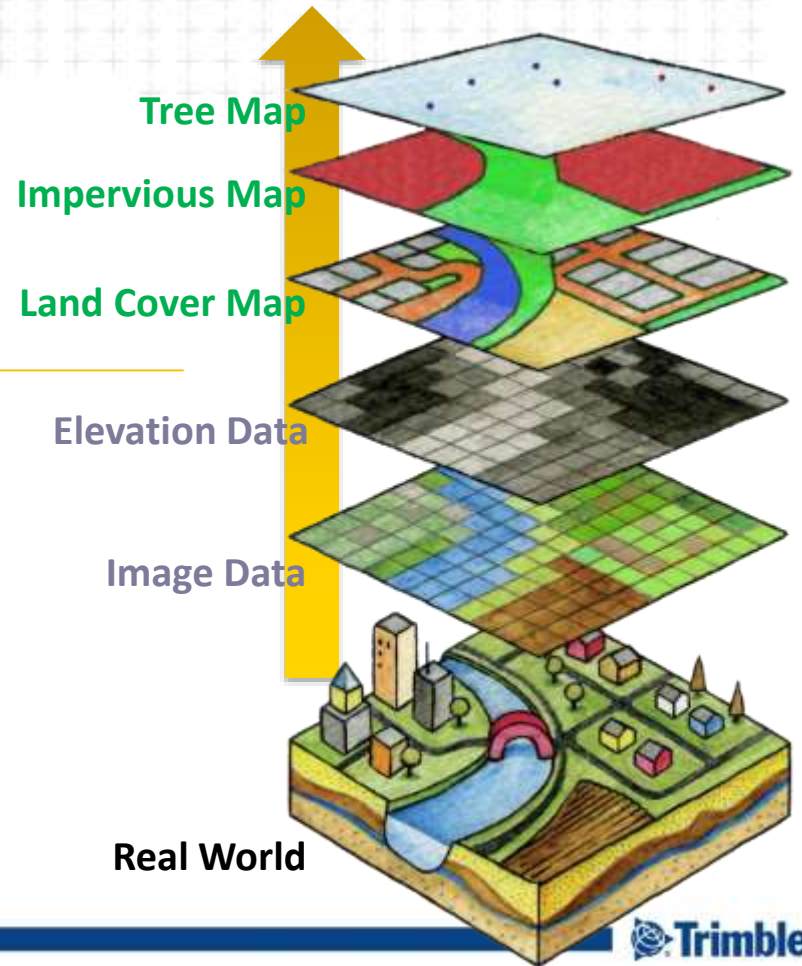
# Earth observation updates and Neural Networks





- Software products for geospatial applications
- Development platform to automate the interpretation of geospatial data

Information  
Data



# eCognition Product Groups



## Developing & Analysis Platform

- Enables users to create analysis solutions to transform geospatial data into geo-information
- Components: Developer, Architect & Server



## Generic Remote Sensing Application

- Out-of-the-box Land Cover Mapping solution for GIS users
- Produce GIS-ready deliverables

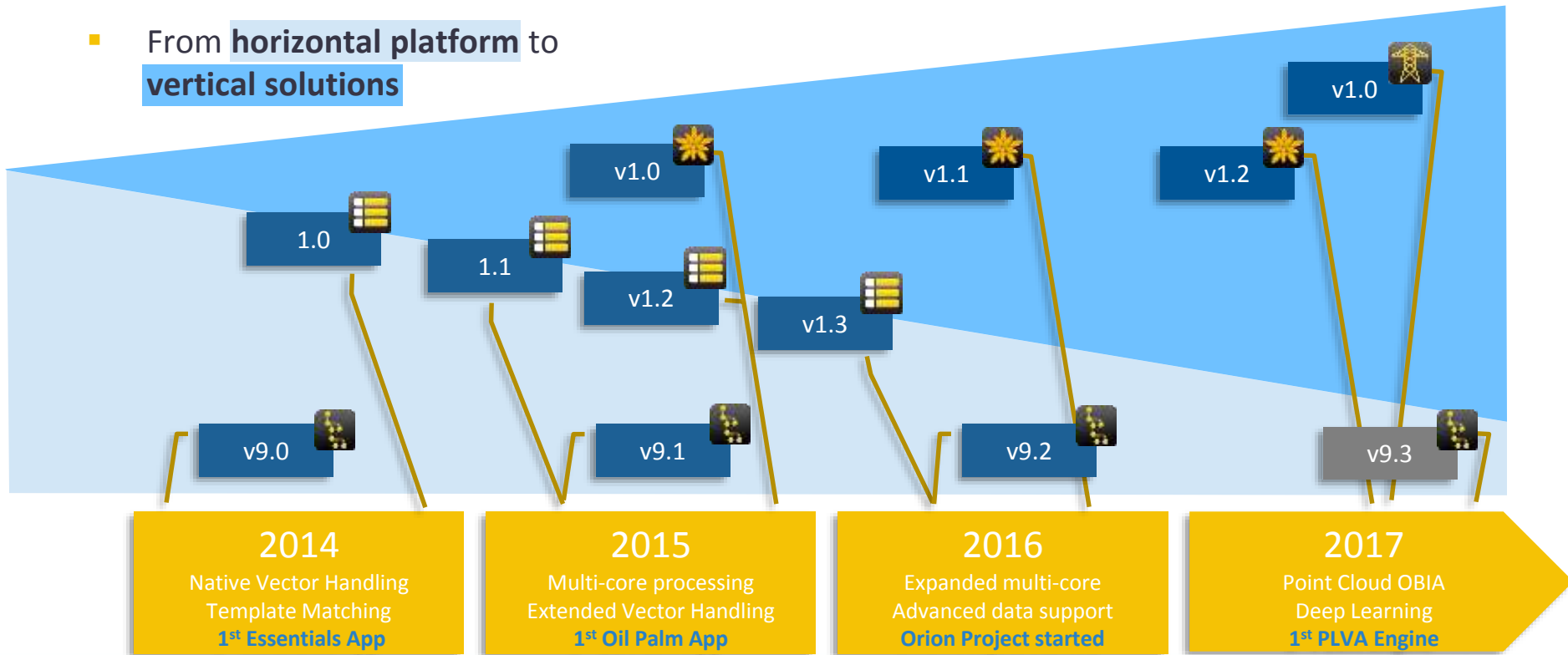


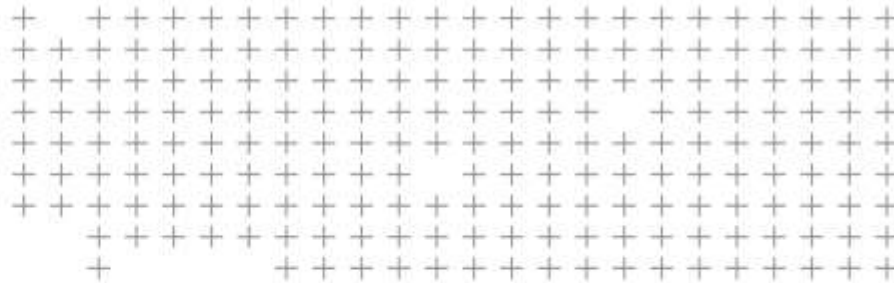
## Vertical Application

- Out-of-the-box eCognition market vertical application
- Specifically for the identification & analysis of oil palm trees from UAV data

# Strategy Change since 2014

- From **horizontal platform** to **vertical solutions**





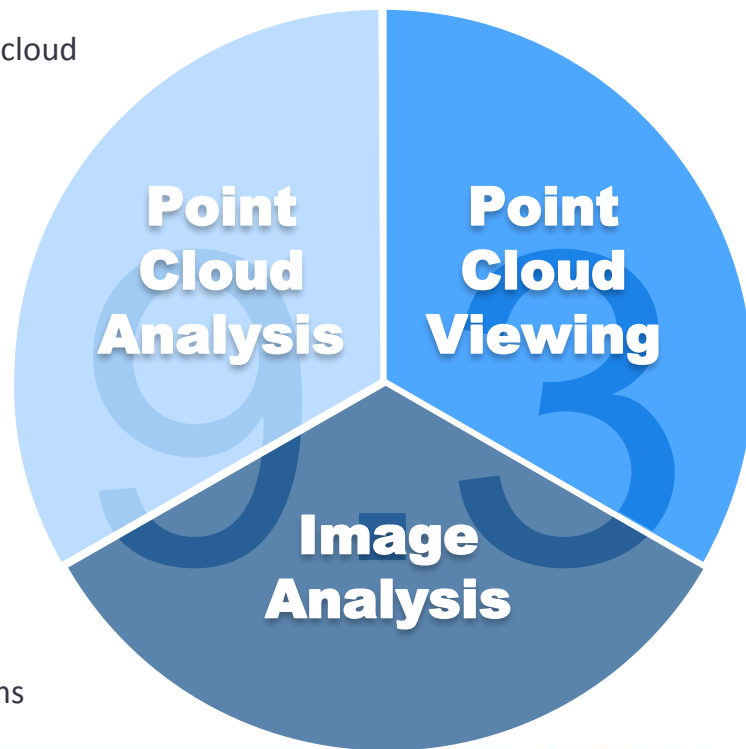
# What's new in eCognition Developer v9.3?

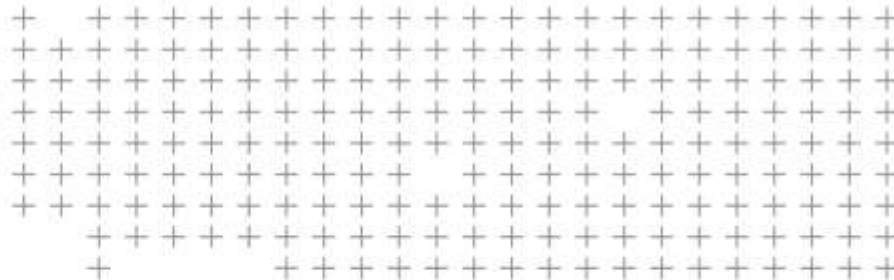
# eCognition Suite 9.3 Motivation

- **Growing importance of point cloud data**
  - Rapid growth of point cloud integration into remote sensing workflows
  - New devices (Geiger-mode LiDAR) & approaches (match dense point clouds)
- **Scientific spotlight on machine learning**
  - Widespread use of neural networks/ deep learning classifiers
  - High potential to solve image analysis tasks faster & more accurately

# eCognition Suite 9.3 Highlights (WIP)

- **Advanced Object Based Point Cloud Analysis**  
Benefit from new point cloud analysis algorithm for automated point cloud classification  
Run tutorials to solve even the most challenging point cloud analysis tasks: Point Cloud Change Detection, Terrain Model Generation, Basic Land Cover Classification
- **Enhanced Point Cloud Viewing**  
Apply new point cloud viewing features to get the full information potential of your input data & to effectively combine raster, vector & point cloud data
- **Extended Image Analysis**  
Leverage state of the art machine learning by Google's TensorFlow library for neural networks to detect patterns & correlations, analogous to the learning & reasoning which humans use  
Faster image object creation with the latest Superpixel segmentation approaches
- **Improved Usability**  
Optimized readability of software dialogs, windows & the Rule Set Tree to provide a uniform experience for high-DPI (4k) displays systems



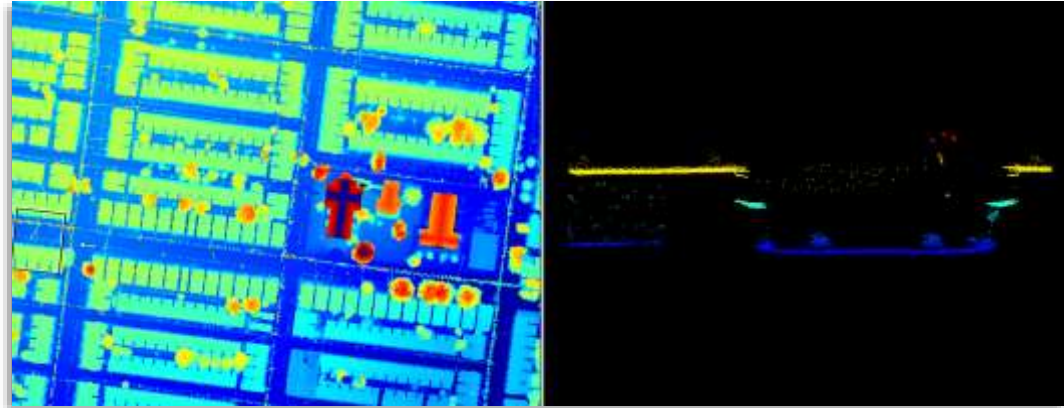


# Point Cloud OBIA



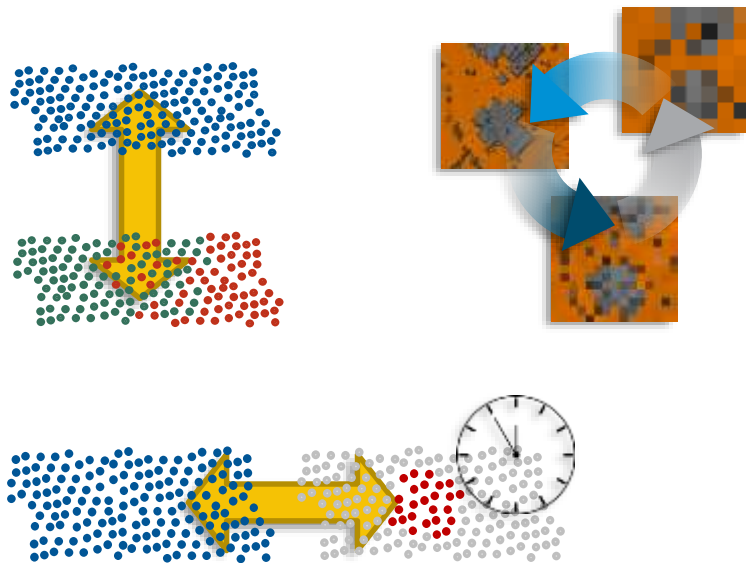
# Point cloud viewer

- Improved point cloud viewer usability
  - 2D & 3D viewing
  - Combining point clouds with image data
  - User-defined viewing modes
    - Perspectives
    - Sliding view



# Object-based point cloud analysis

- New point cloud algorithms:
  - Rasterize point cloud
  - Create temporary point cloud
  - Transfer point cloud information
  - Export point cloud
  - Assign class to point cloud
  - Automatic point cloud classification



# Use case: generate DTM



Point Cloud input (\*.LAS)

Rasterized Point Cloud

DTM from Point Cloud

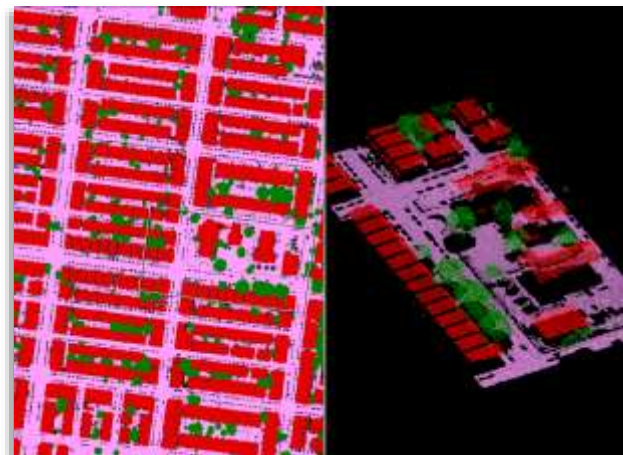
# Use case: point cloud classification



Point Cloud input (\*.LAS)

Point Cloud classification

- Ground
- Buildings
- Trees



# Use case: change detection (I)

T1 DSM



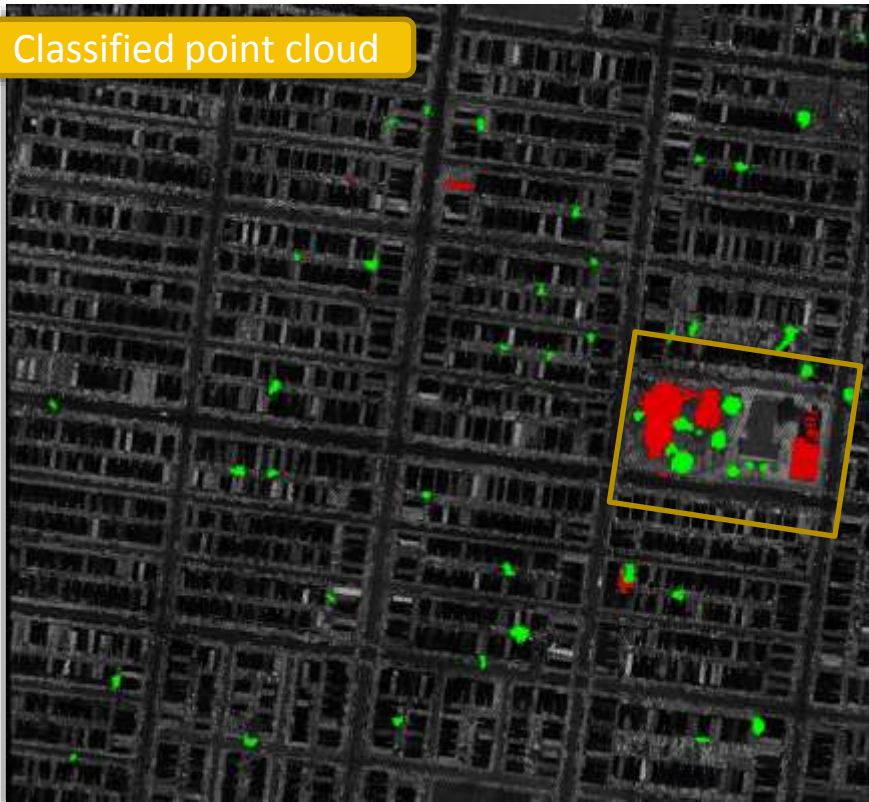
T2 DSM



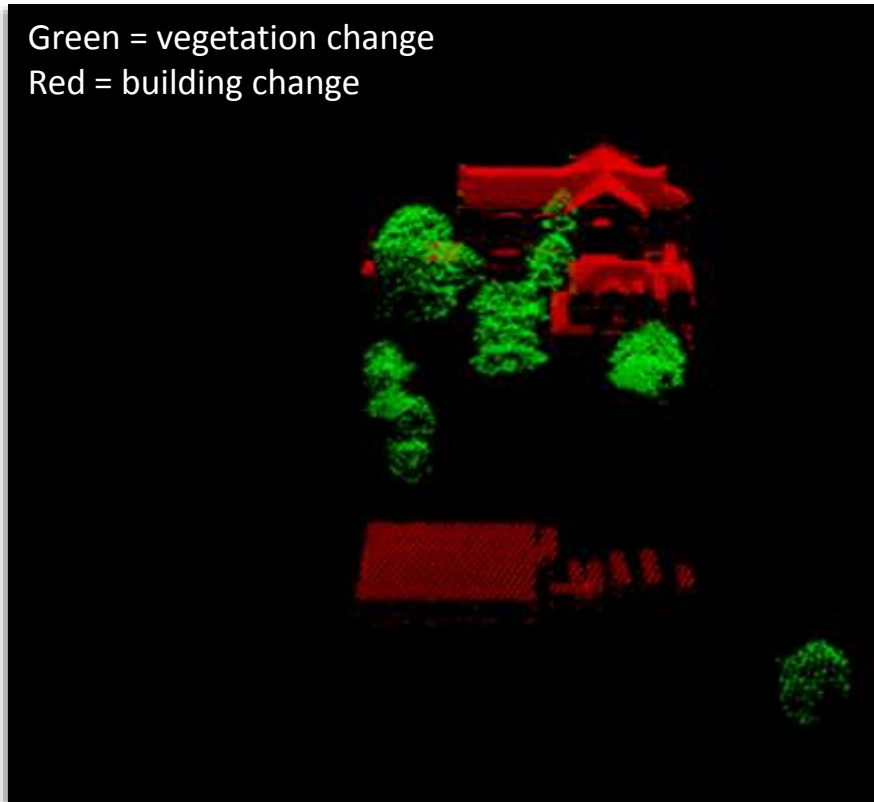


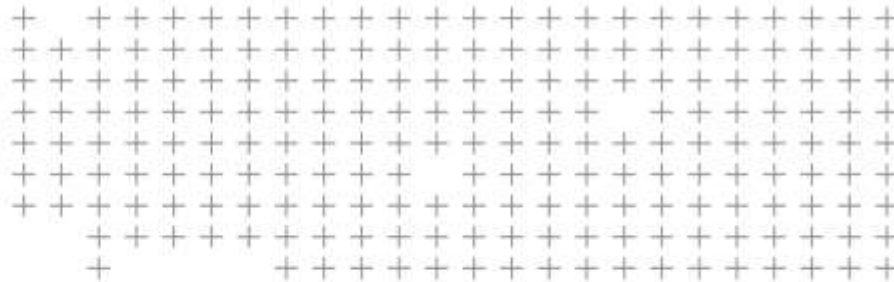
## Use case: change detection (II)

Classified point cloud



Green = vegetation change  
Red = building change





# CNN & Deep Learnign

# CNN Overview

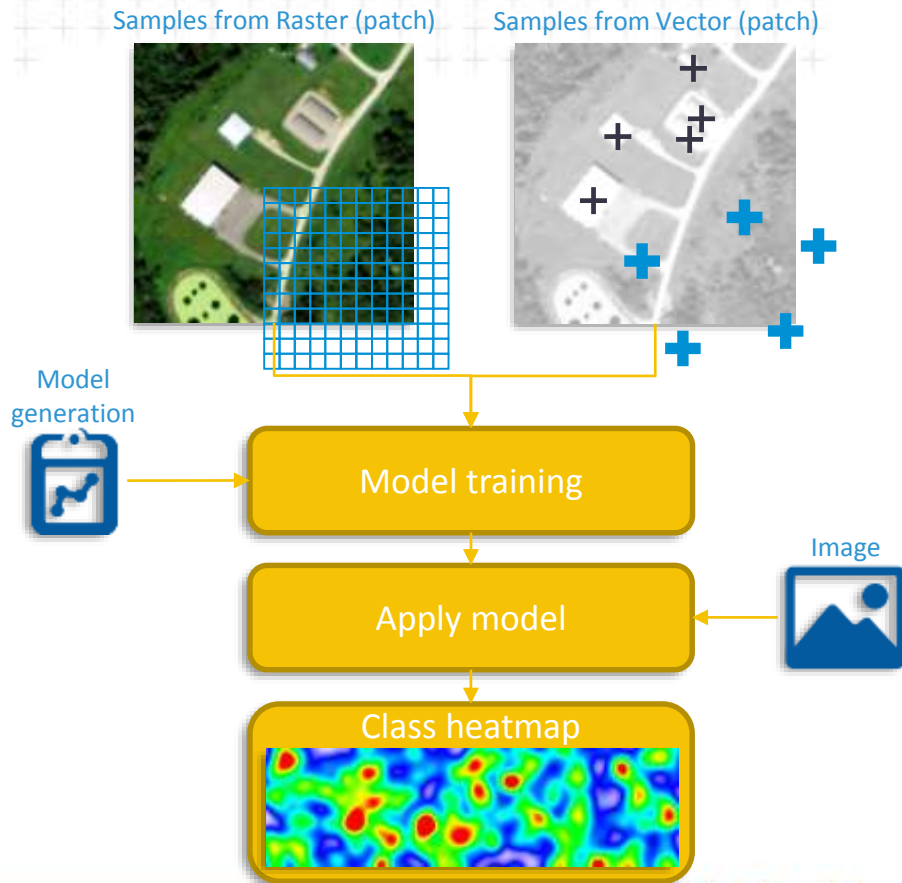
- What is a Convolutional Neural Network/ “deep learning”?
  - Composition of non-linear transformation of the data
  - Goal: automated detection of features in images
- How does it work?
  - A CNN has many information layers that each learn to detect different features of an image. Filters are applied to each training image at different resolutions & the output of each convolved image is used as the input to the next layer to identify features





# CNN in eCognition

- New CNN algorithms
  - Create samples patches
  - Create model
  - Train model
  - Apply model
  - Save & load model



# CNN - Demonstration (I)

- Example: classification of thematic map objects

Step 1 – sample patch generation



Non-targets



Targets

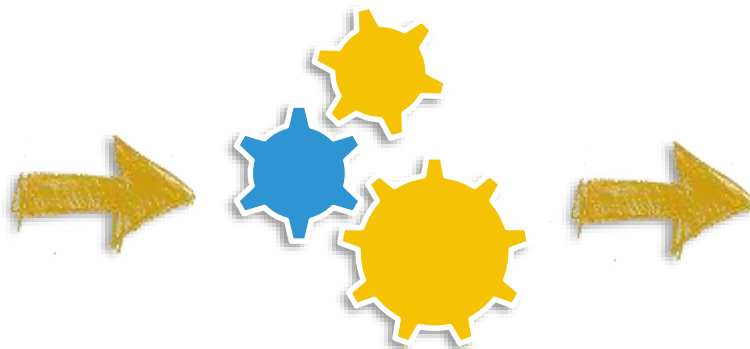
# CNN - Demonstration (II)

- Example: classification of thematic map objects

Step 2 – train model



Samples patches



Trained model



# CNN - Demonstration (III)

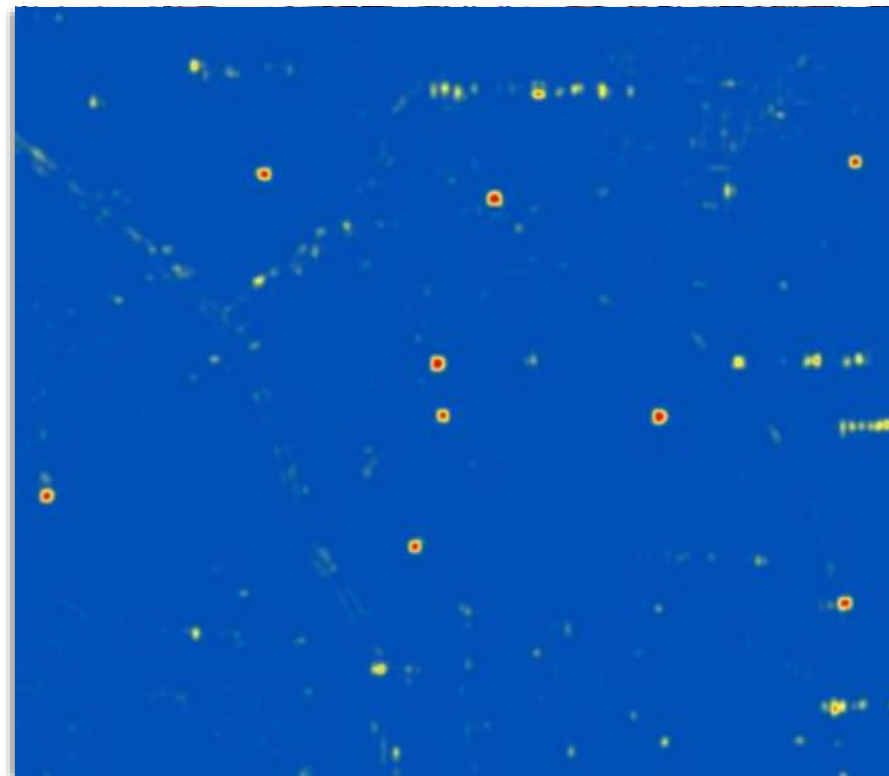
- Example: classification of thematic map objects

Step 3 – apply model



# CNN - Demonstration (III)

- Class heatmap layer
  - With values 0-1
- Can be used in Ruleset
  - Multi-threshold segmentation
  - Classification





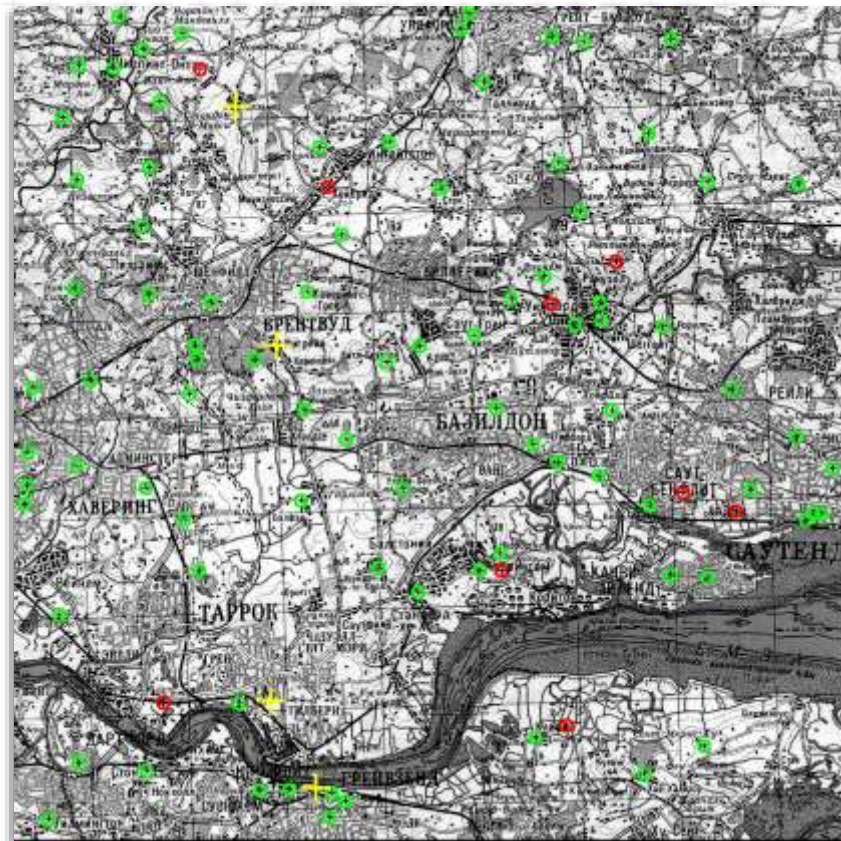
# CNN - Demonstration (IV)

- Classification results

-  Correct

-  Incorrect

-  Missed target



# Summary

- eCognition v9.3 adds **3D point cloud analytics & deep learning technology** to enable more robust & accurate analysis for a broader range of applications



# Ordering, Availability & Resources

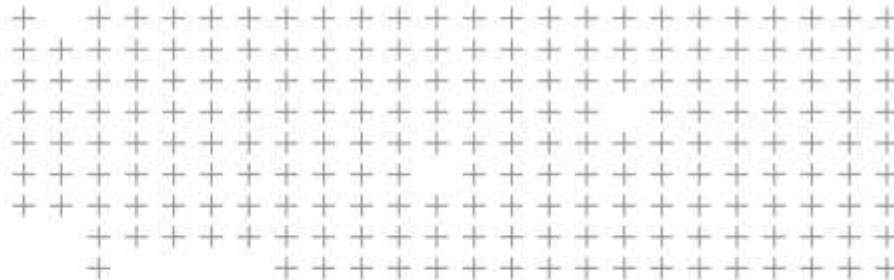
## eCognition v9.3

- **Announcement:** Intergeo 2017
- **Release Date:** During Q4
- **Who's eligible?**

All users with a valid maintenance contract as of October 2017

- The software is available in the **Customer Download Area:**  
<http://www.trimble.com/imaging/downloads>
- Get the **Free Trial** and learn more about Trimble eCognition on  
<http://www.eCognition.com>
- Visit the **eCognition Community** (more than 14.000 users) to ask questions, follow discussions, download guided tours, and give feedback on <http://www.eCognition.com/community>





# What's new in INPHO suite and UAS Master

# The Use Of Multi-Head Oblique Cameras

Precise detailed surface models require full 3D (vs. 2.5D)

Especially rich city models leverage the additional information coming from oblique views – photorealistic textures on facades, data underneath bridges etc.

Multi-head cameras offer all required perspectives in one flight



# Our Commitment To Highest Precision - Our Motivation



Exact Georeferences without parallaxes is the key and sets the basis for any precise deliverable and extracted information.

Only exact georeferences of obliques (perspective facing towards facades) allow for non-blurred textures on buildings.

# Challenges

## One GNSS/IMU – Multiple Cameras – Extreme Perspectives

- Which images belong to the exposure event
- Which images **belong together**
- How good is the **synchronization** of the sensors
- How stable are the **offsets** between the cameras
- How can I **calibrate** the offsets as well as the individual cameras
- Increasingly **bad ray intersections** towards the horizon with obliques
- Bad ray intersections with neighboring cameras
- How can I guarantee a good **tie point distribution** with totally different perspectives

# Status Of MATCH-AT

- Already very positive feedback of inpho-users as well as nFrames SURE users!
- Further enhancements (discussed in the presentation) ongoing
- Engagement with camera manufacturers (e.g. IGI) and users to optimize workflows and results



# Dense Matching – Point Clouds

- For traditional true orthos 2.5D point clouds may be sufficient
- For 3D city models a precise 3D point cloud is essential
- Successful dense matching raises the need for absolute parallax-free stereomodels
- Careful selection of suited image-combinations is required

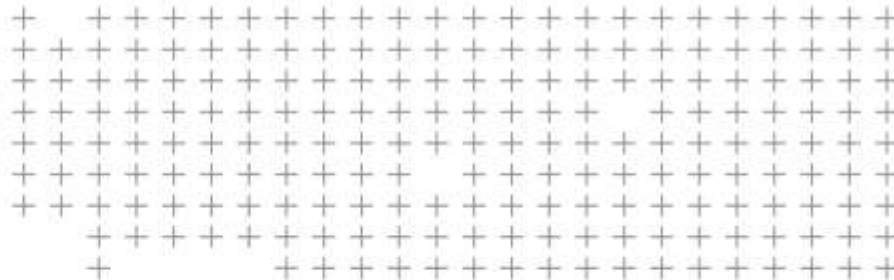


Stay tuned news after InterGEO!

# Availability

- Announcement for Intergeo
- Free update for existing customers on maintenance
- Available during Q4





**UASMaster v9.0**



# Presenting New Software Versions

## UASMaster 9.0

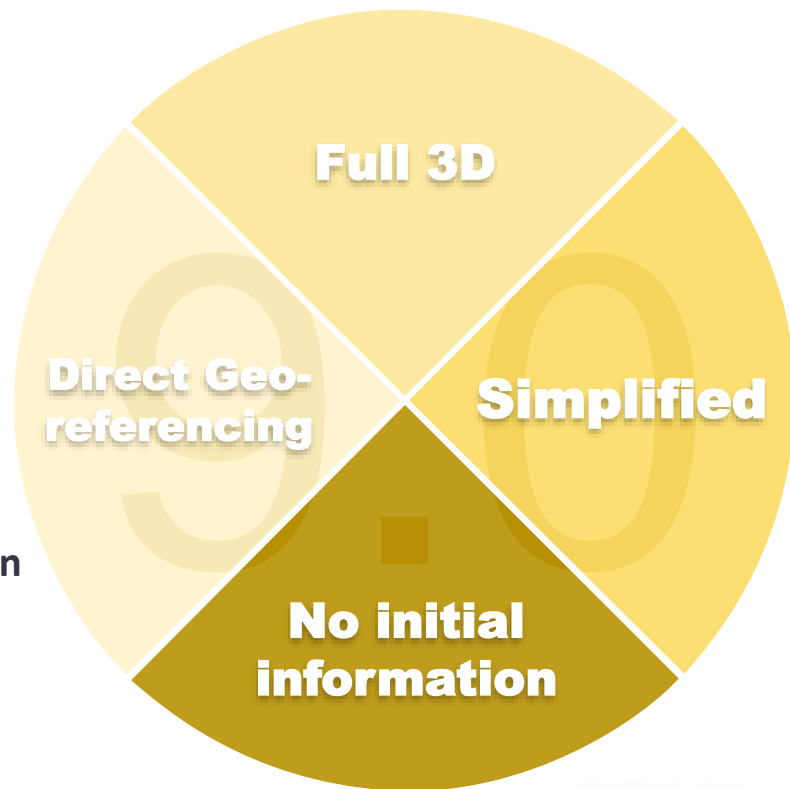
- Announcement: INTERGEO
- Availability: October

UASMaster 9.0 offers full 3D close-range and oblique support for hand-held and multicopter systems – complemented with high quality direct georeferencing workflows.



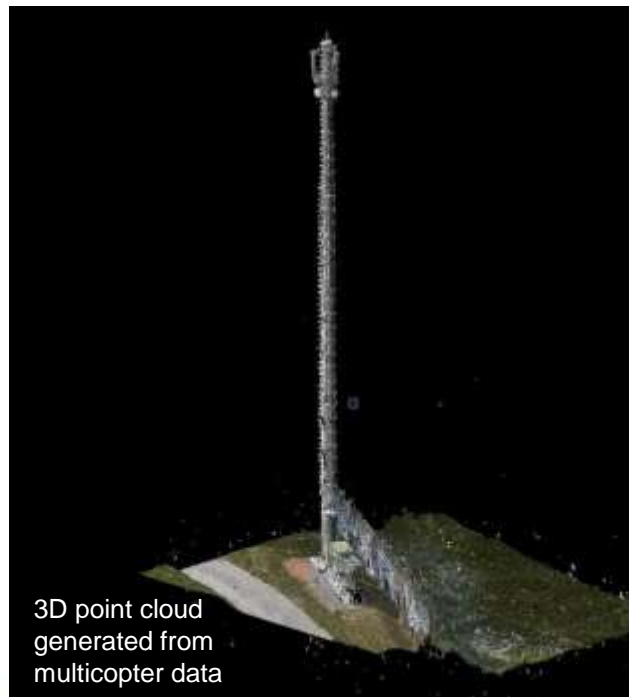
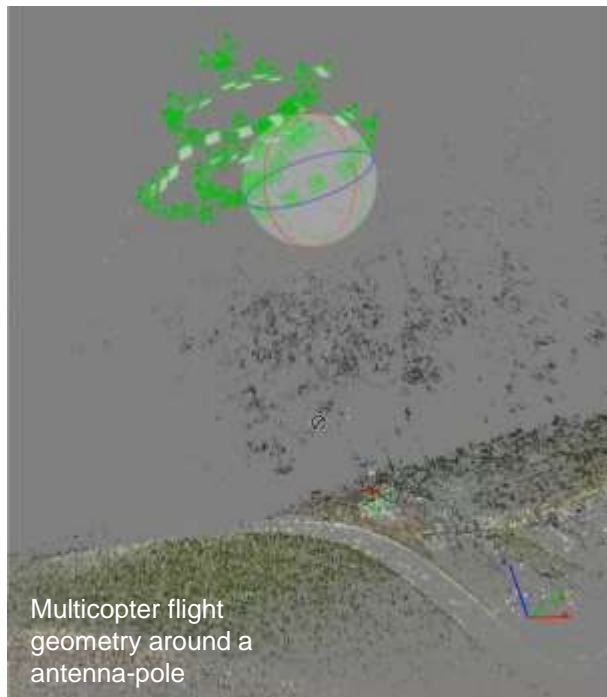
# UAS Master 9.0 Highlights

- **Full 3D Support – multicopters & close-range**
  - Complete 3D reconstruction
    - buildings, bridges, tall free-standing objects like antennas etc.
- **No initial information (camera & position) required**
  - New application scenarios:
    - terrestrial close-range hand-held cameras
    - self-made low-budget drones.
- **Simplified definitions for novice users**
  - perfect results from the start
    - Less settings e.g. leveraging EXIF
    - More intuitive one-click options
- **Direct Geo-referencing and Market-Leading Precision**
  - Reliably process most challenging projects
    - corridor surveys,
    - flights over water or other low textured areas,
    - lack of ground reference points etc.



# New in UASMaster 9.0

- Close-range/Multicopter geometries Support



# Availability

- Announcement for Intergeo
- Free update for existing customers on maintenance
- Available during Q4





eCognition®



THANK YOU FOR YOUR TIME

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