Development trends of photogrammetric technologies

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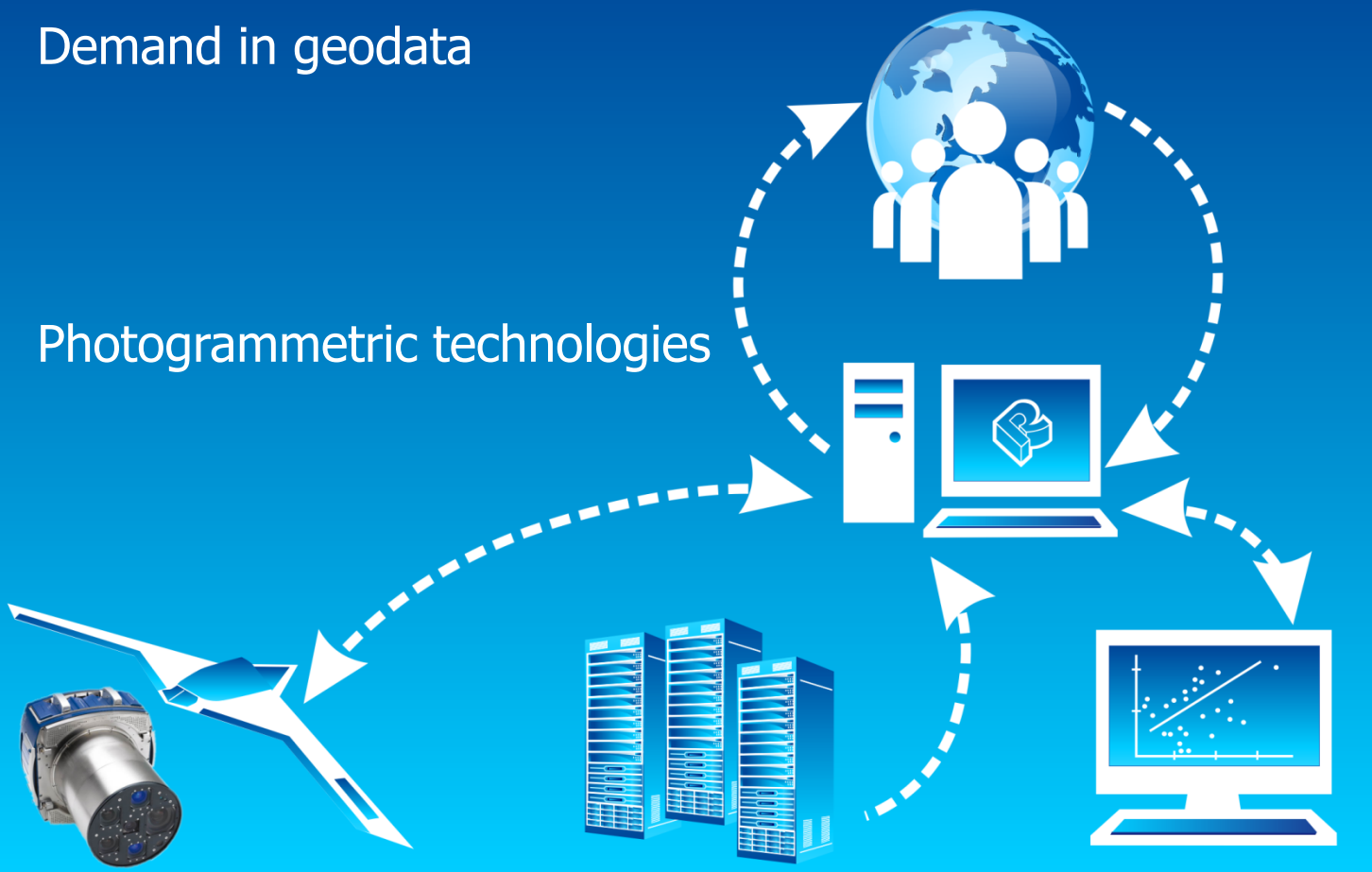
- Sensors & platforms
- Computer tools
- Development of algorithms
- Photogrammetry in cloud
- Creation of 3D-models
- Conclusions

Factors of development

Demand in geodata

Photogrammetric technologies



Sensors & platforms

Computer tools

Algorithms

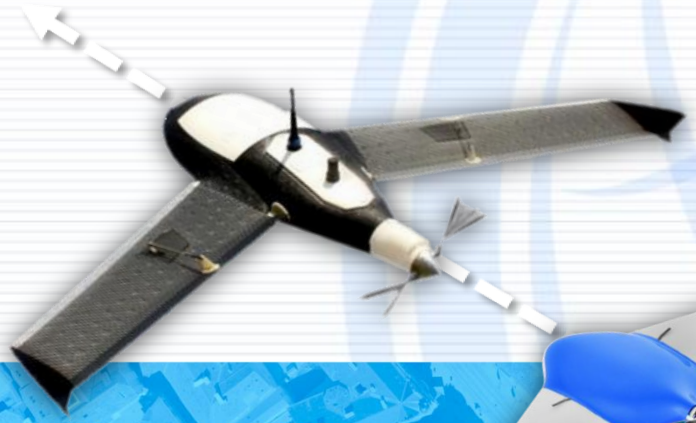
Geodata - tendencies

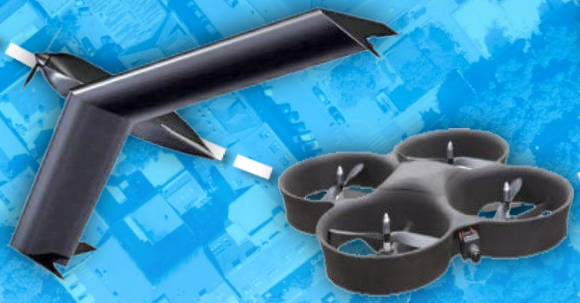
- Increasing number of non-professional users
- Variety and availability of tools for working with geodata (web-services, gadgets, augmented reality...)
- Variety of geodata representation forms: paper maps, digital maps, orthoimages, terrain models, 3D-models, 3D-GIS

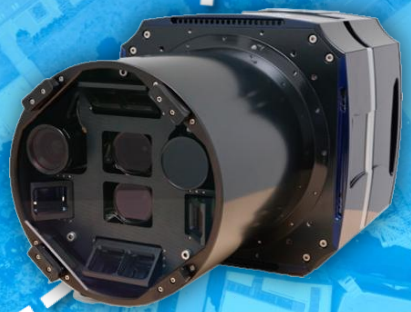
- Using of geodata by machines (unmanned transport systems, robots…)
- New requirements to forms and content of geodata: From map to digital reality – «reality of smart machines»

Sensors & platforms

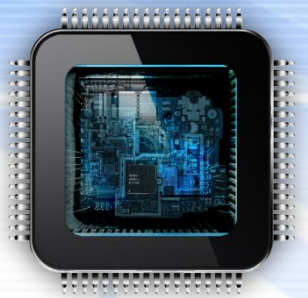
- Spatial and radiometric resolution is near to saturation
- Mapping with UAS
- Multicamera systems – oblique imagery
- Increasing amount and variety of space RSD







Computer tools

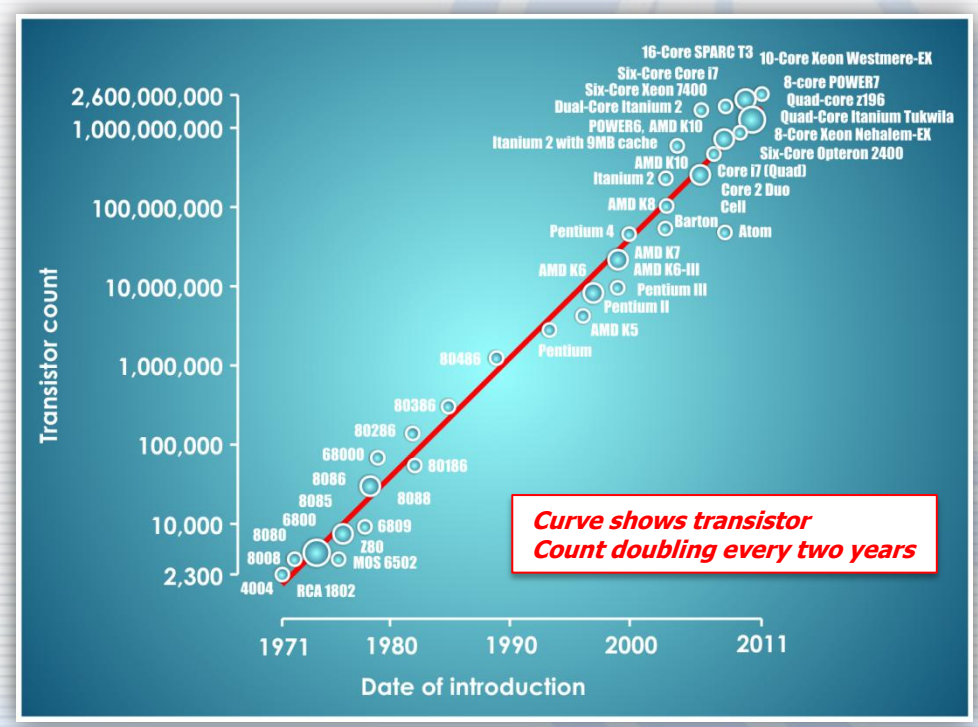


- Processing power
- Distributed (parallel) computing: LANs, cluster computing, cloud services
- Mass storage capacity
- Communication speed

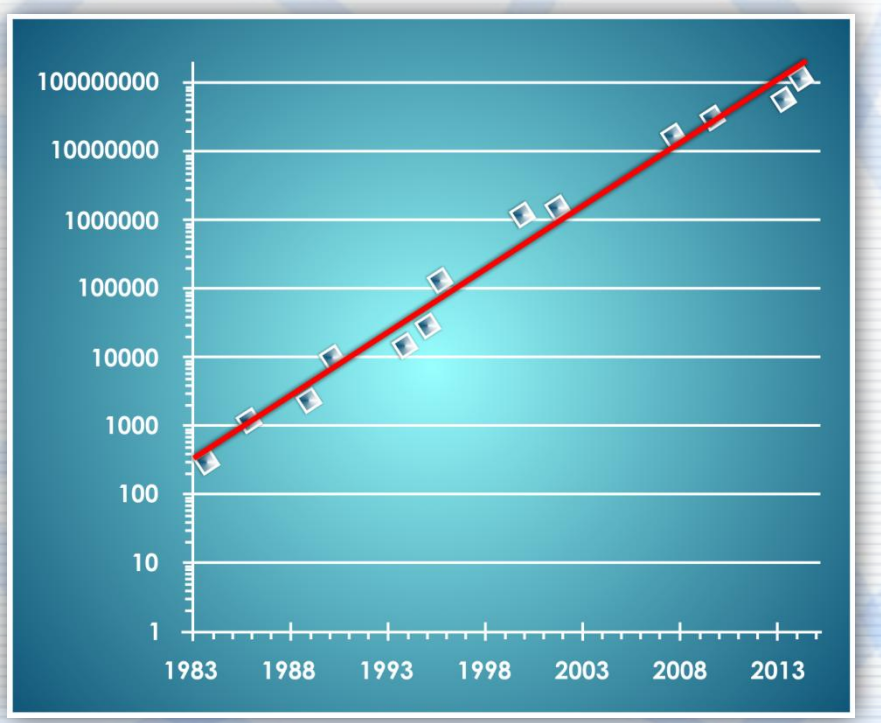
Computer tools

- Processing power - Moore's law
- Communication speed – Nielsen's law

Microprocessor Transistor Counts 1971-2011 & Moore's Law

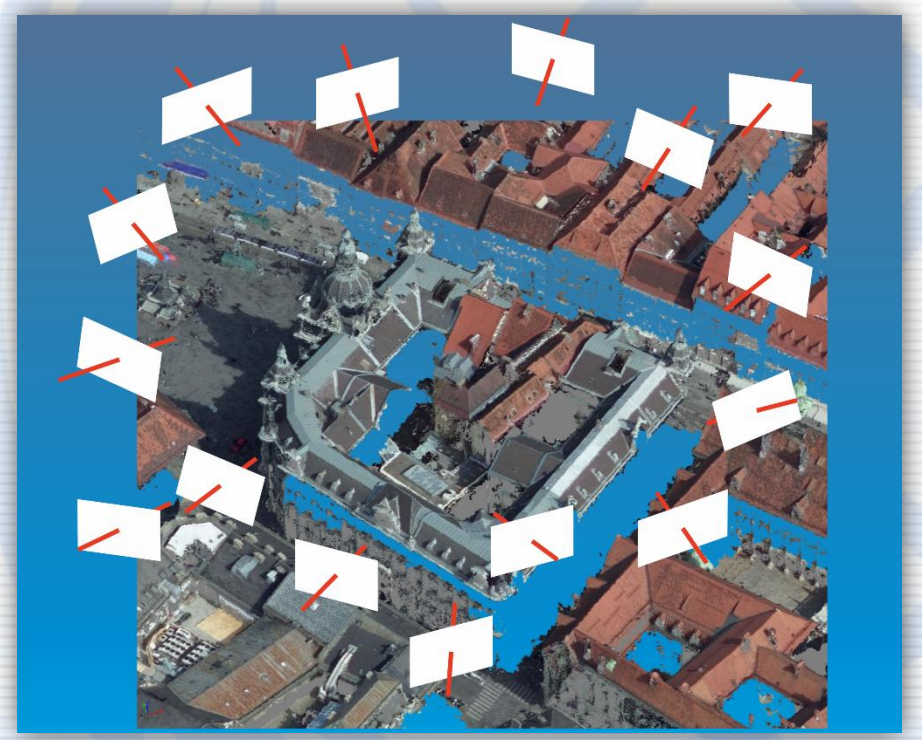


Internet Connectivity (Bits Per Second)

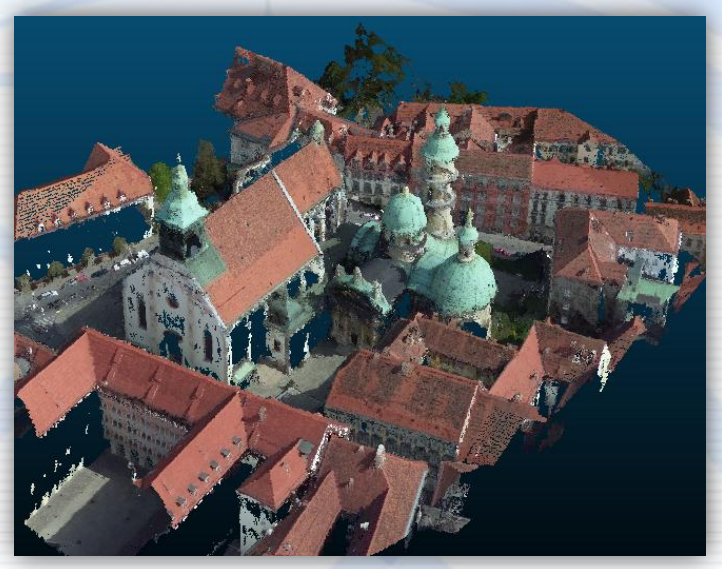


Algorithms of processing

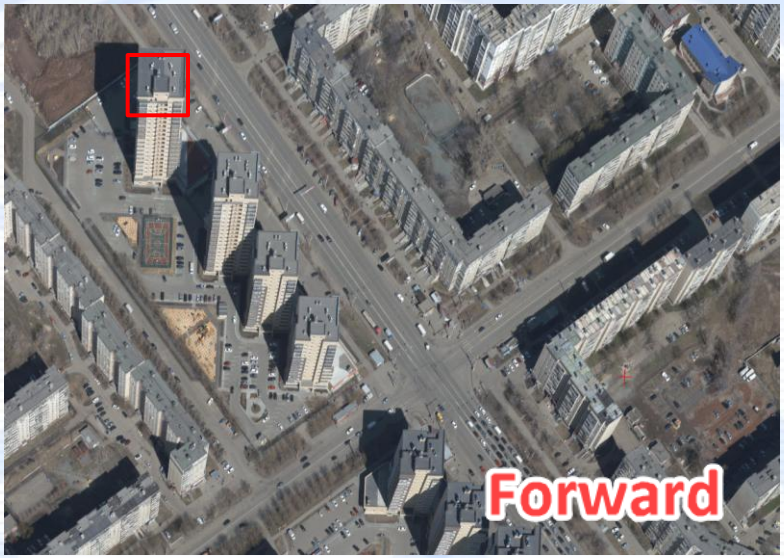
- Matching – Structure from Motion
- Multi-ray photogrammetry
- Dense (pixelwise) models of terrain/surface
- Data management (distributed computer architecture, Internet, clouds)
- Automation of feature extraction

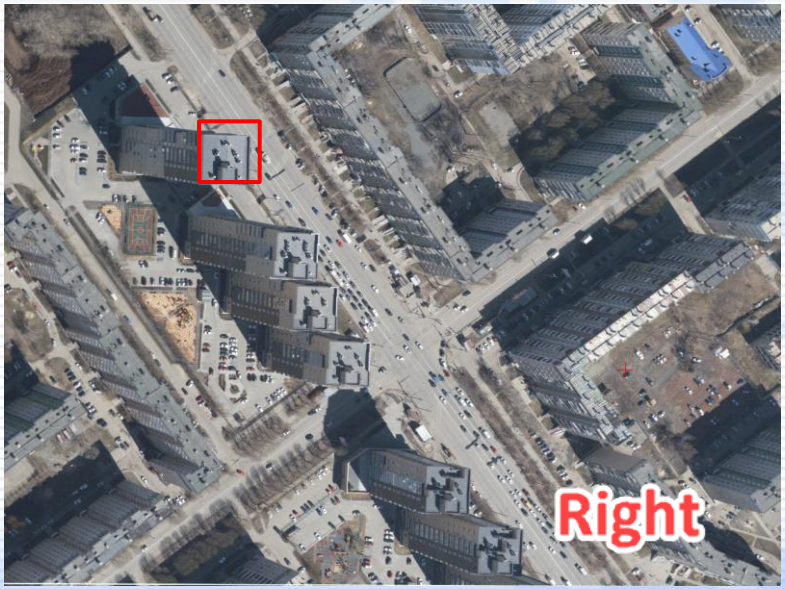


Dense DSM (SGM)

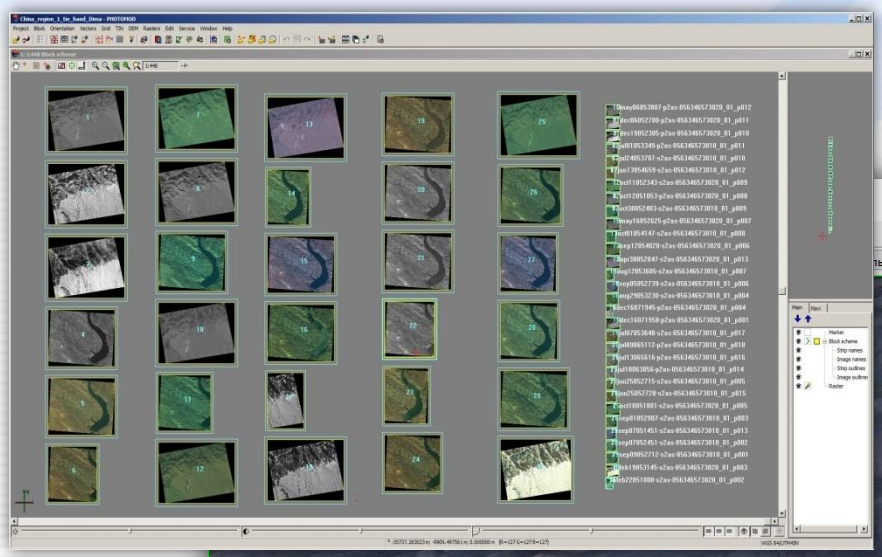


True-Ortho (Penta)



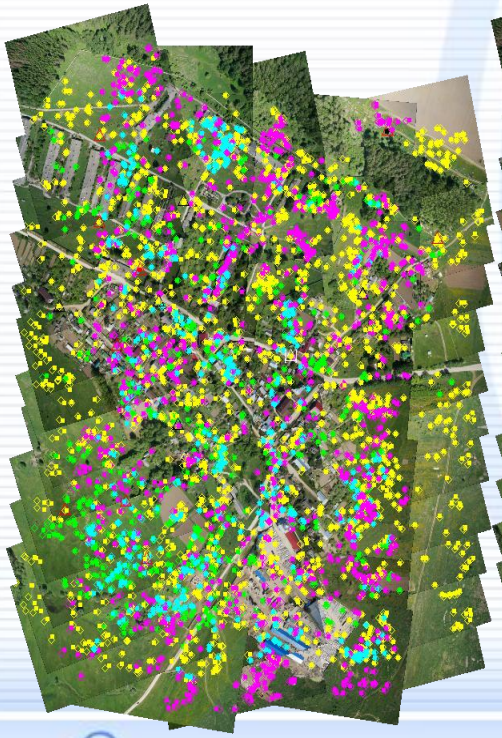


Terrain model from multitemporal space images

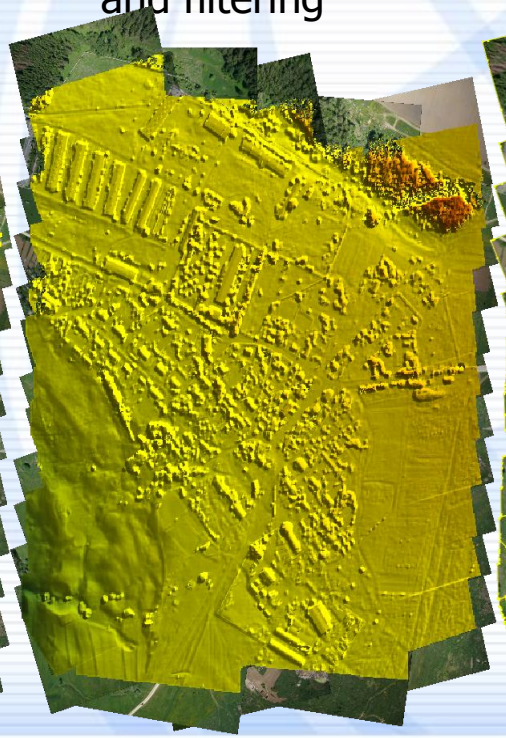


Automation in photogrammetric processing

aerial triangulation



DEM building and filtering

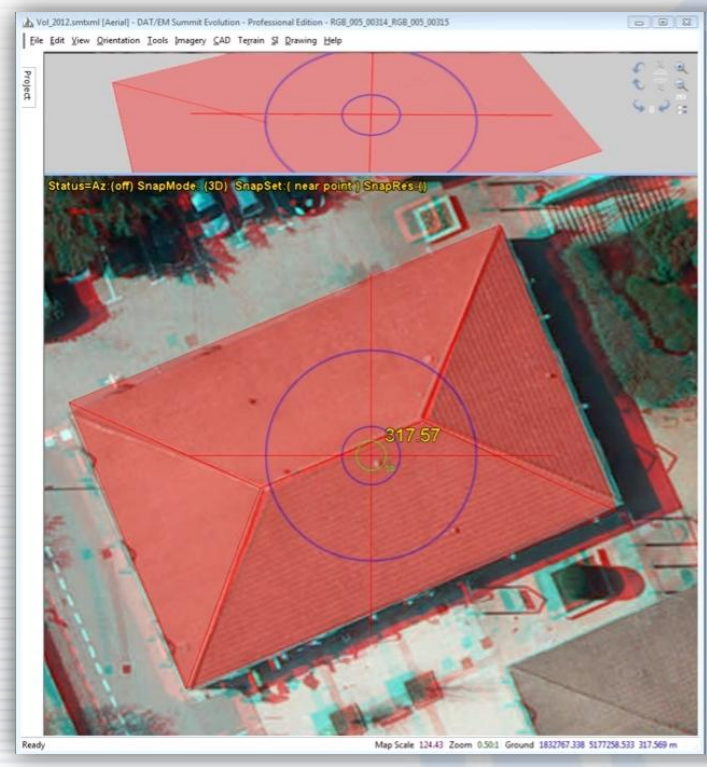


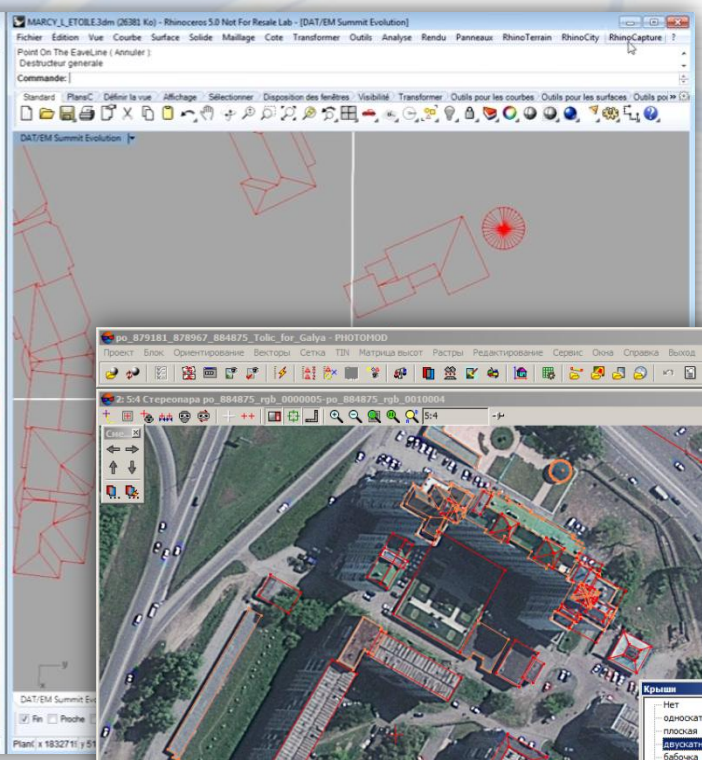
orthomosaic seam lines and color balancing

stereo feature extraction

Automation in 3D vector model creation

Automation in stereo feature extraction



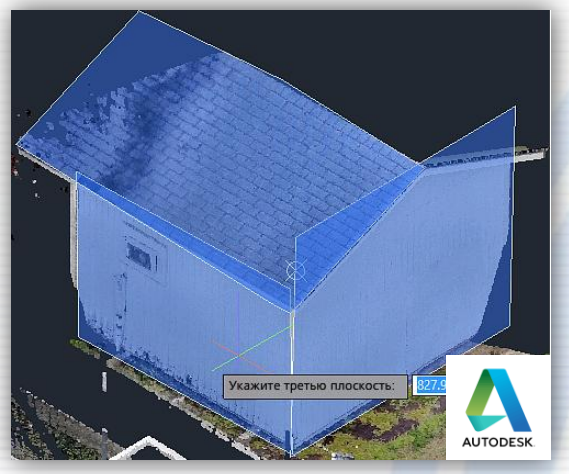


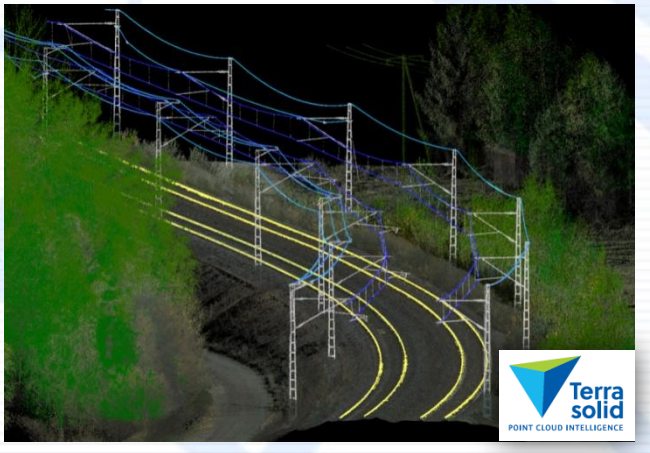
RhinoCity

PHOTOMOD

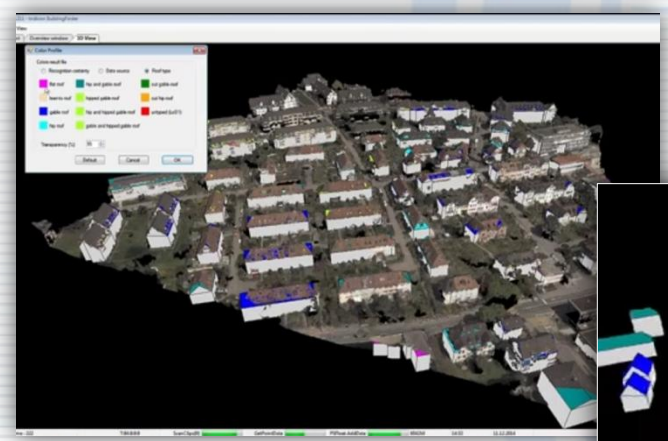
Automation in 3D vector model creation

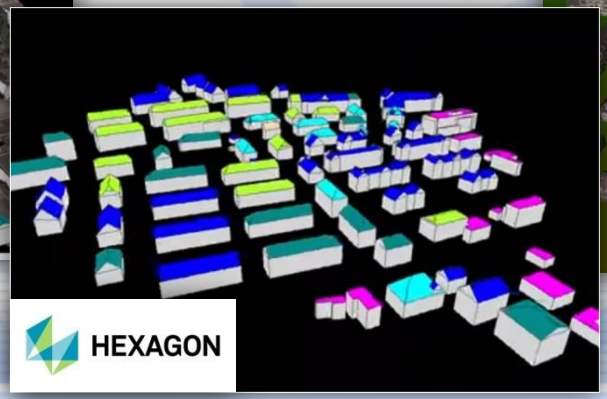
Automation in point clouds processing

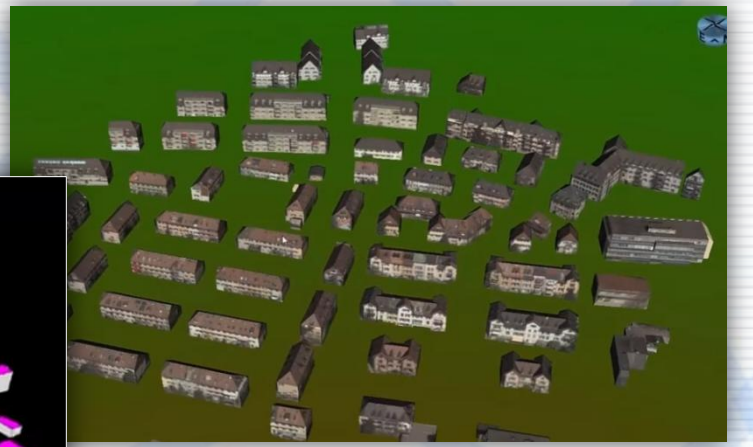




Automated segmentation, building extraction and linear objects recognition from point clouds. Automatic texturing







High productive automatic solutions

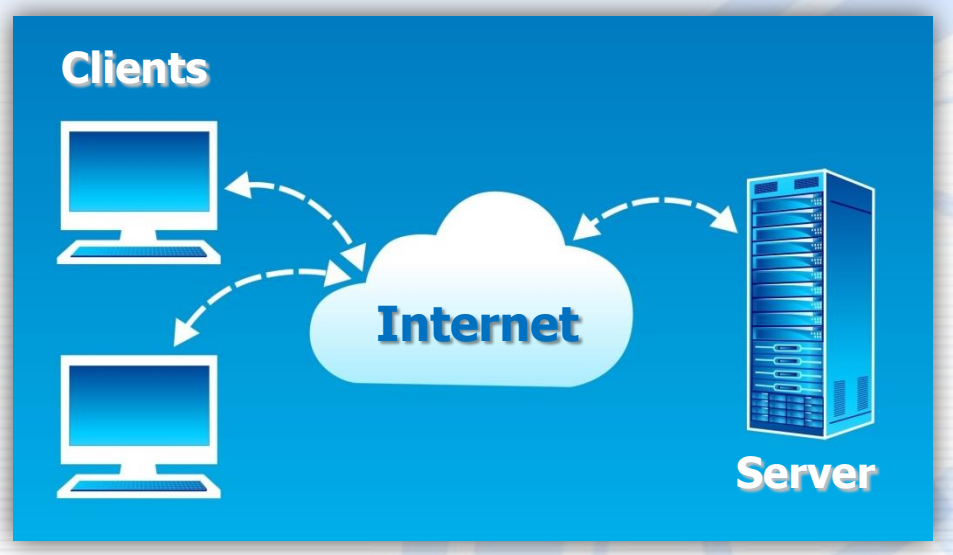
Creation of orthomosaics from space images and external DTM (PHOTOMOD Conveyor S)

- Images input and project creation
- Cloud aware image selection
- Orientation of images (with RPC)
- Orthorectification using external DTM
- Seam lines creation
- Geometry alignment using tie points
- Radiometric alignment

Creation of DTMs and orthomosaics from aerial and space images (PHOTOMOD Conveyor SA)

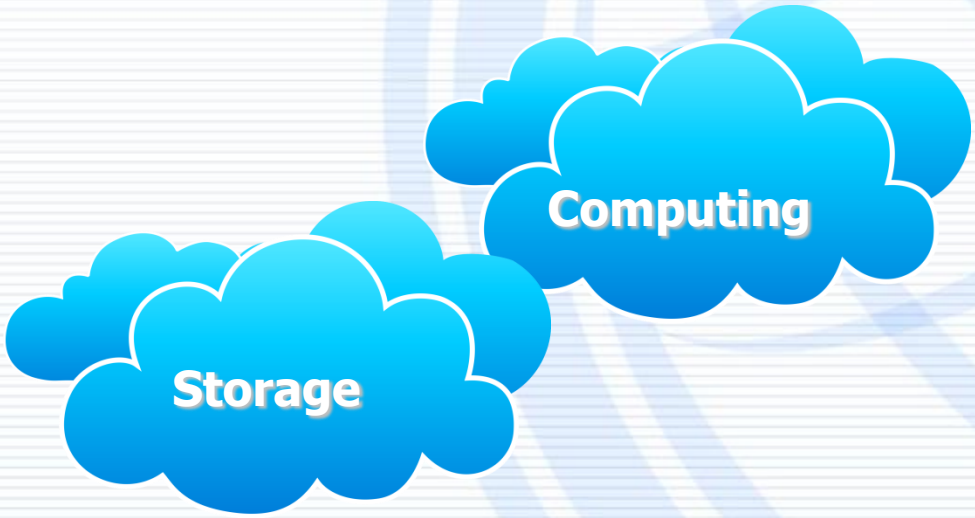
- Images selection based on time and parameters of acquisition (for scanner imagery only)
- GCPs measurements using GCP sketches
- Tie points measurements
- Block adjustment
- Creation of terrain models in form of: mass points, TIN, DEM and contour lines
- Creation of dense DSM
- Orthorectification using the created or external terrain model
- Seam lines creation and radiometric adjustment
- Seamless orthomosaic creation split into map sheets

Photogrammetry in clouds



Client-server architecture

Cloud storage and cloud computing can be separated



Stereo control/measurements

Pros & Cons of cloud processing

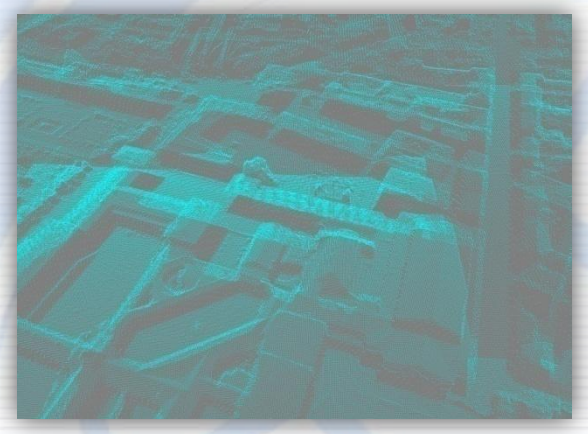
- Cheap access to unlimited computation power
- Efficient licensing model of processing software – SaaS
- (Sometimes) fast and efficient access to data (on the same cloud platform) - DaaS

- Data secrecy and/or privacy limitations
- (Sometimes) problems with transfer of big volume of data from customer location to cloud and back

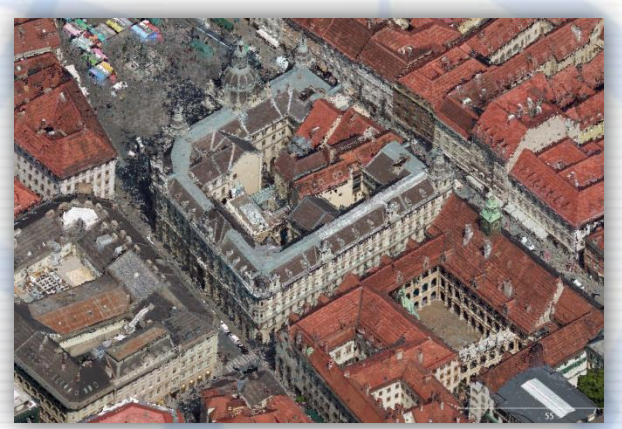
3D models

Dense surface models (SGM)

Digital surface model

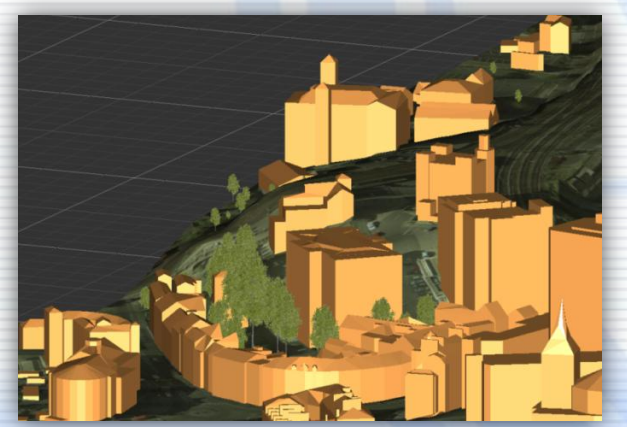


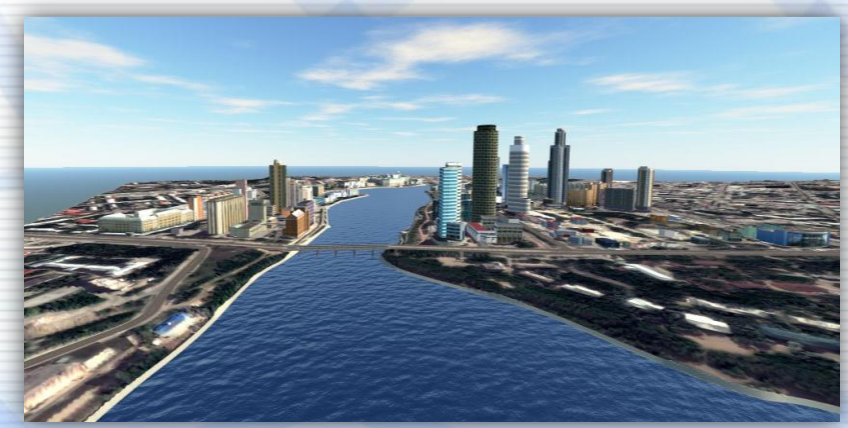
3D points



3D textured model

Vector object-oriented model





Conclusions

- Photogrammetric technology progress depends on evolution of sensors and platforms, increase in productivity of computer tools and new efficient algorithms developments
- One of directions of photogrammetric technology developments is the development of special high-productive solutions for fully automatic creation of such products as orthomosaics, terrain models and 3D-models
- Cloud technology development leads to appearance of new models of photogrammetric production workflow and services
- Modern photogrammetric algorithms allow creation of accurate and detailed 3D-models of cities and objects both as point clouds and vector models. Such models can used as a spatial backbone of comprehensive 3D GIS

What's next?

- Sensors & Platforms - Stratospheric UAVs?
- Computer tools - Quantum computers?
- Algorithms - Artificial intelligence?
- 3D modelling – 4D real time models?

Thank you for attention !