

# OBJECT-BASED IMAGE ANALYSIS FOR IDENTIFYING SMALL SCALE ELEMENTS DURING LARGE SCALE PUBLIC EVENTS

## Assessment and interaction of segmentation methods and machine learning

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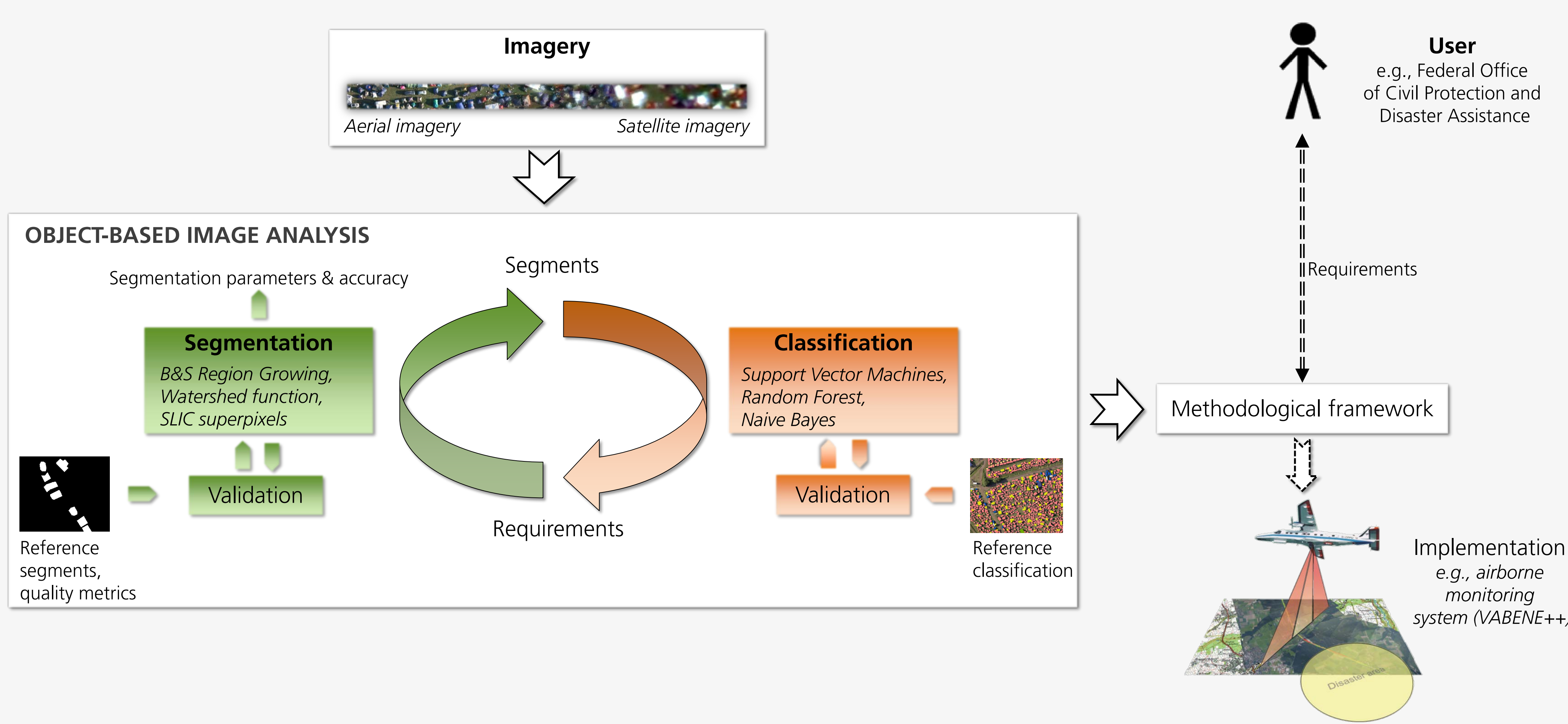
**Major public events** such as **open-air festivals** are characterized by large concentrations of people in relatively small areas. These events represent challenging situations for public authorities concerned with organization, traffic and security and for festival organizers. In the **research project VABENE++** an end-to-end monitoring system has been developed in order to provide situational and traffic related information in near real-time based on terrestrial and airborne platforms.

In the present study, the potential of **object-based image analysis (OBIA)** for the extraction and classification of small scale features in the context of large scale public events is examined. The features to be identified involve different types of vehicles and tents. A first step involves a quantitative evaluation of segmentation quality and the investigation of the **relationships** between **segmentation** and **machine learning** algorithms.

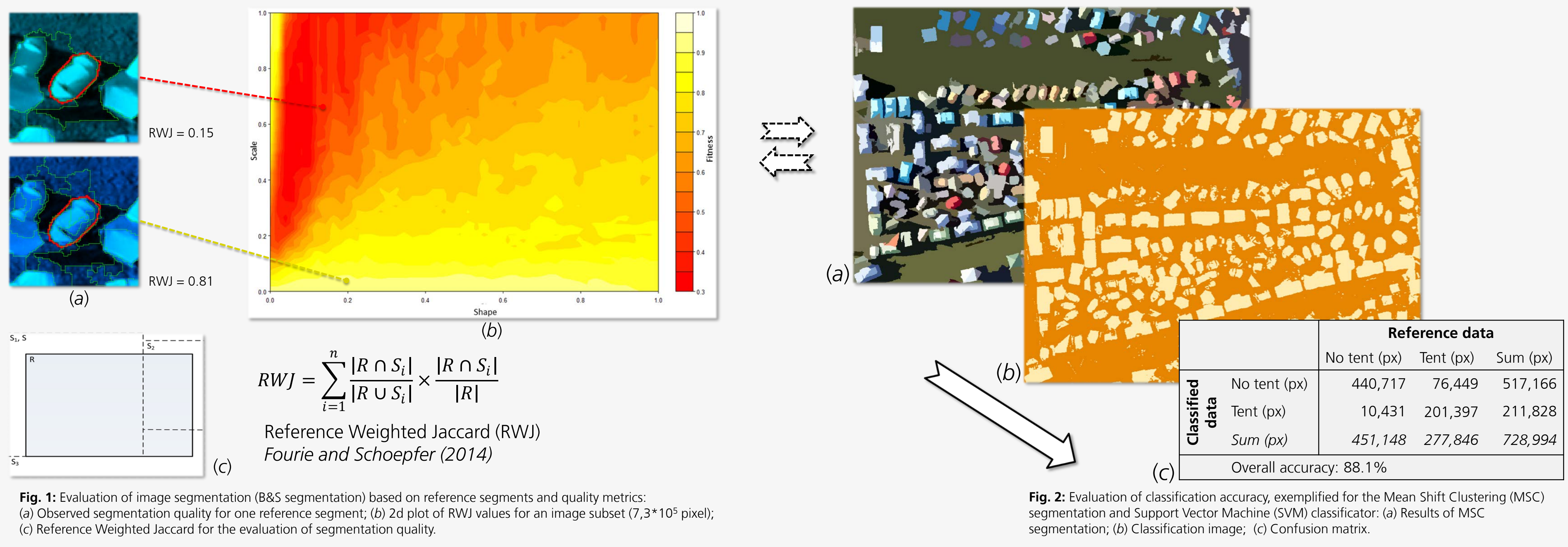
Methods are evaluated considering **computational cost**, **thematic accuracy**, **robustness/transferability** and the amount of **user interaction**. Finally, a methodological framework is developed as a basis for the development of (semi-)automatic processors to be implemented in the existing airborne monitoring system of VABENE++. Even though methods are predominately tested and compared using very high resolution aerial imagery, it is also assessed if and to what extent **lower resolution imagery from optical satellites** (e.g., WorldView-2) represent appropriate alternatives for the same objectives.

Possible application scenarios in the context of large scale events may involve the monitoring of the occupancy of **parking and assembly areas**, **camping sites** and the estimation of the number of **overnight guests** and the assessment of the **accessability of emergency and escape routes**.

### Concept

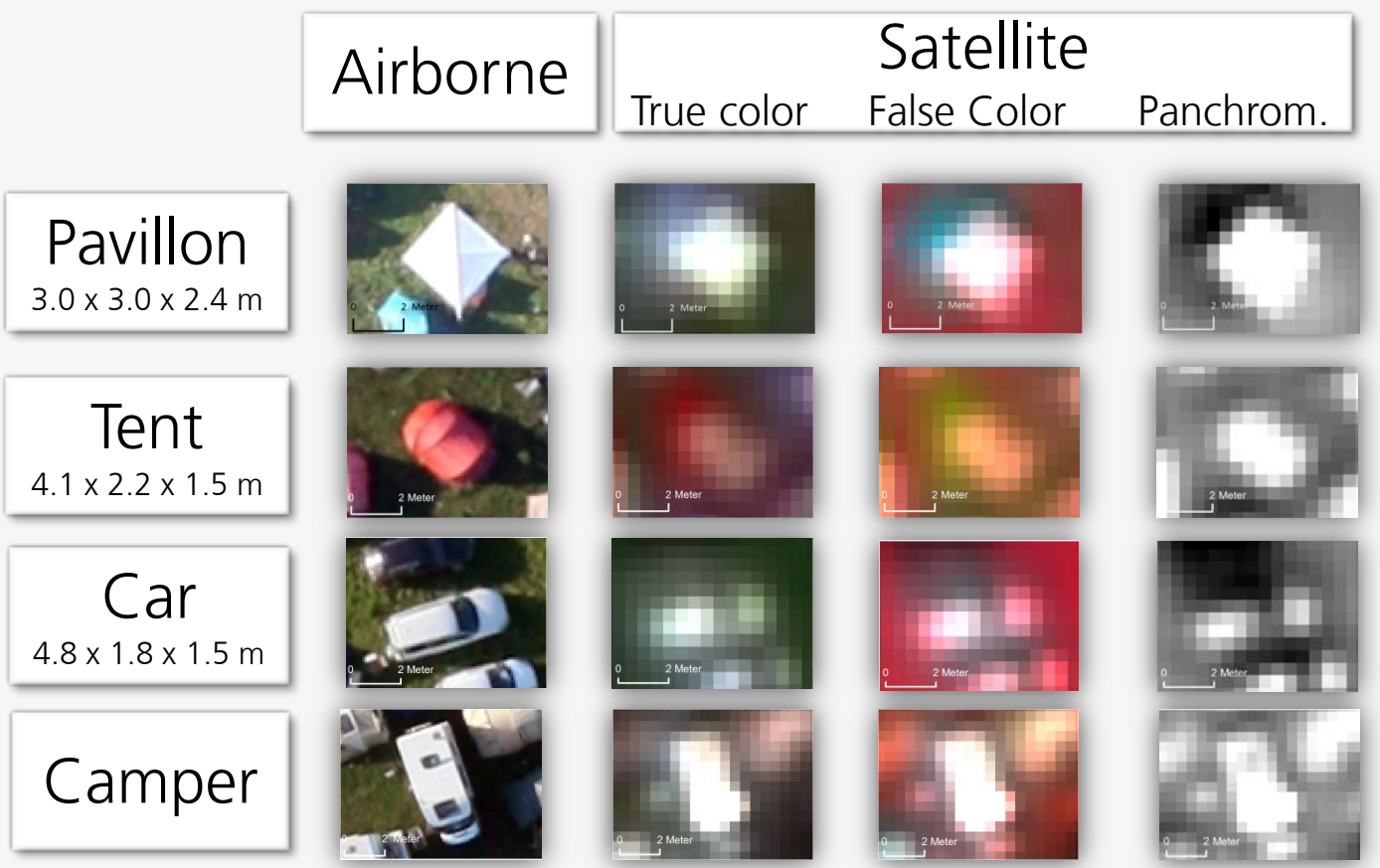
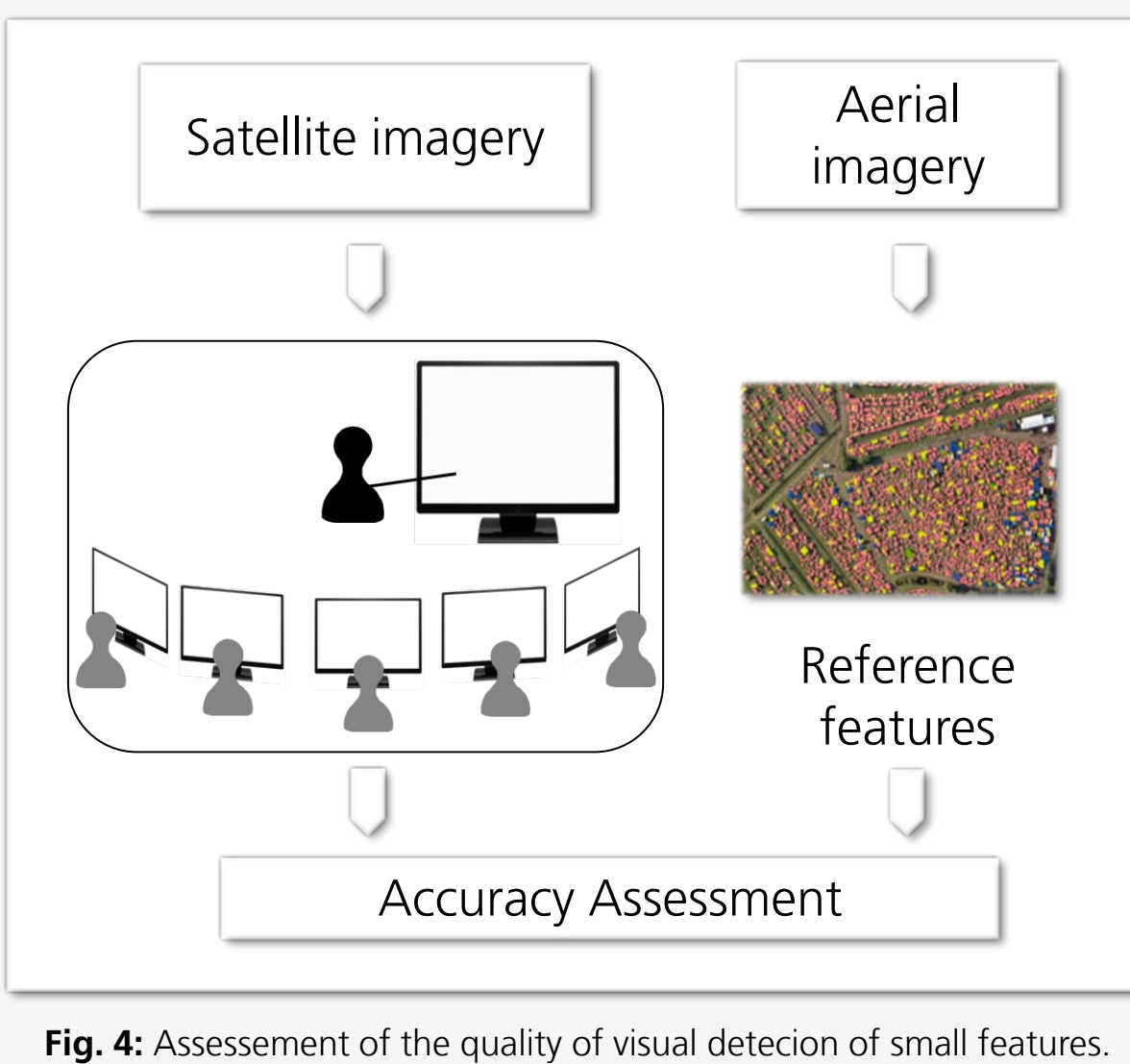
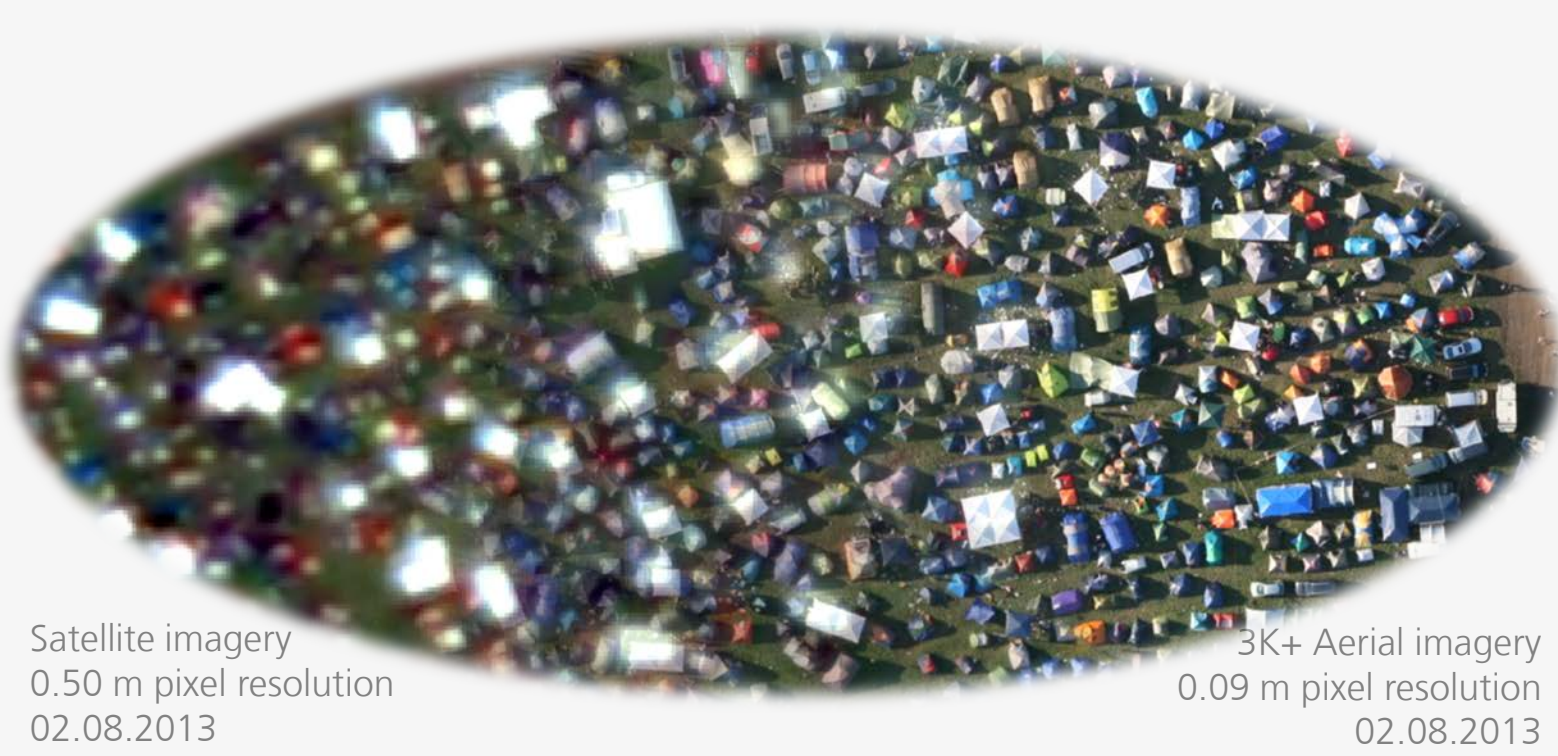
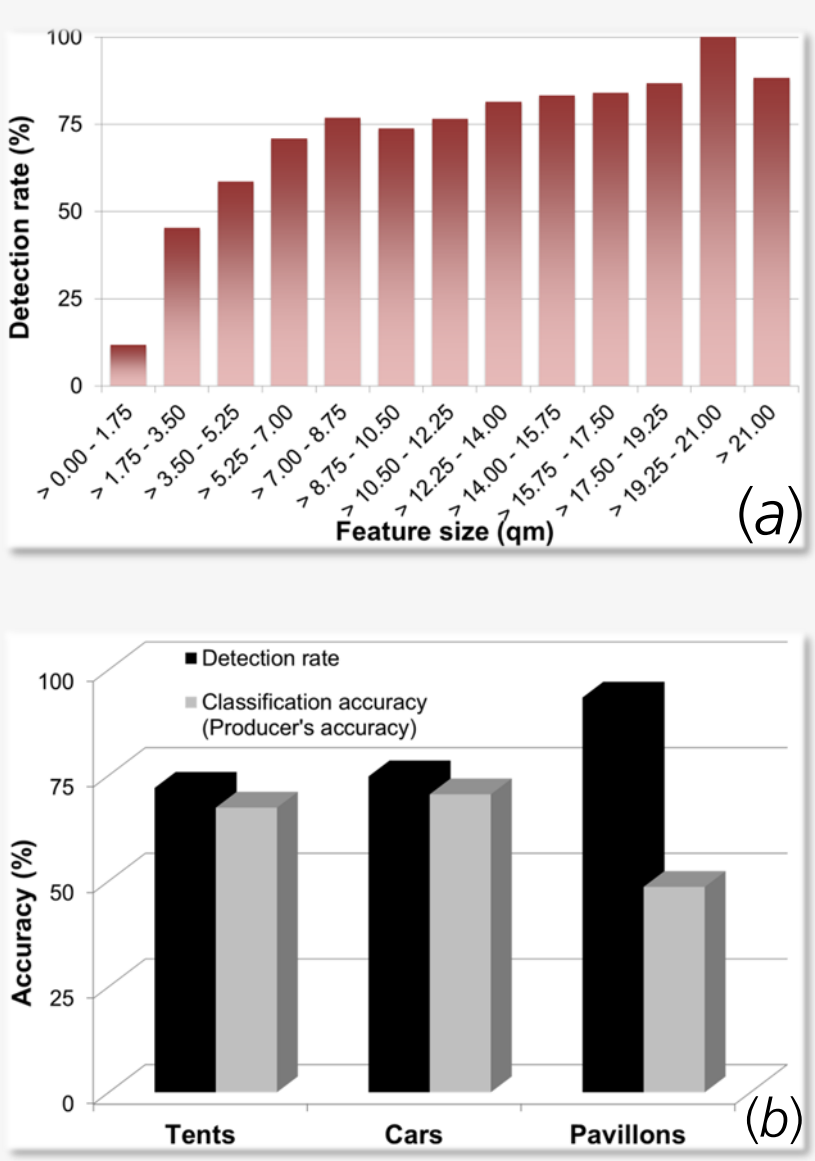


### Segmentation and classification



### Scaling aspects

**Scaling issues** are investigated through the evaluation of the **visual interpretation of satellite data**, acquired on the same acquisition date as the aerial imagery. Detection rates and classification accuracy were estimated based on a **coordinated experiment with five skilled image analysts**. First results show that feature detection strongly depends on **feature size**, **spectral contrast** between feature and surroundings and **spectral brightness**. The observed detection rates were 72%, 75% and 93% for the classes tents, cars and pavilions, respectively (cp. fig. 3b).



**Fig. 5:** Catalogue of selected small features and multi-scale visualization.

The results of the scaling experiments provide also relevant information for users, such as the Federal Office of Civil Protection and Disaster Assistance of Germany (BBK), regarding the **suitability and reliability of satellite imagery for comparable application cases** and scenarios where accurate reference information is usually not available. These cases involve **uncontrolled growing refugee and IDP camp structures**. The (multi-scale) visual appearance of relevant features and the observed classification & detection rates are presented in a reference catalogue (fig. 5).

