Initial situation

Imaging reconnaissance gathers information of military importance on an area of interest by means of recording and analyzing aerial and satellite images. It is therefore an ideal means of enhancing the protection of German armed forces in the country of assignment and improving their effectiveness. A key task in imaging reconnaissance is the recognition of objects (e.g., land vehicles or ships) and the description of their characteristics based on recognizable graphical features. Specially trained image analysts perform this task, which requires extensive knowledge of objects and their characteristics. To date, this knowledge has been disclosed in hard-copy manuals, which can only be updated at longer intervals.

Due to an increase in foreign assignments, the German armed forces are confronted with a growing number of objects that cannot be found in a conventional reference book. At the same time, requirements in terms of a more flexible deployment and shorter training phases increasingly restrict the availability of image analysts for specialization with respect to all objects relevant for their assignment.

Solution

To guarantee high analytical quality despite these limiting factors, the recognition assistant RecceMan was developed at the Fraunhofer IOSB. This interactive tool supports an image analyst in object recognition by allowing him to describe the object in question based on known object features in the image, thereby assisting him in identifying the object type. To this end, RecceMan provides the image analyst with an overview of the visually recognizable features of the objects to be analyzed in order to facilitate the recognition process.
The overview of features is rendered both as a tree (tree of features) and pictographically. A list-like overview of all objects occurring in the domain, which may be candidates with respect to object recognition, is also provided. A profile is available for each object candidate, which delivers detailed visual and text-based information (viewable media) on the object candidate. In order to identify an unknown object, the image analyst highlights the identifying features in the tree-like or pictographic overview of features whose presence he is able to confirm or rule out on the reconnaissance image. This reduces the set of object candidates to those with the selected features. The features, which are relevant for further selection, are also highlighted. The image analyst is then alerted as to which characteristics of the object he is to focus his attention on in the image and which are irrelevant for identification regardless of their prominence on the image. If the resulting number of objects is manageable, the analyst is able to orient himself in the profile (based on the preview images in the object list and the detailed images and text descriptions) in order to make his final decision on the identity of the object.

**RecceMan® product**

The realization of RecceMan as a software product was commissioned by the Federal ministry of defense technology and procurement (BWB) and as of 2010, has been used as an operational system at aerial image analysis facilities of the German armed forces.

The RecceMan software consists of the following components:

- Recognition component:
  Assistant for object recognition in imagery-based reconnaissance
- Recognition training:
  Training tool for training analytical and recognition skills
- Object editor:
  Editing tool for entry and editing of reference objects and their illustrative material
- Features editor:
  Editing tool for creating and modifying identifying features for describing the object
- Data management component:
  Administrative tool for managing, archiving and distributing the data set.

Each software component is realized as a dedicated Java application and can therefore be run on all common operating systems.

The RecceMan data set currently covers the domains of land, air and marine vehicles and is maintained by the German armed forces.

With the editors, the data set can be expanded to include further domains (e.g. buildings, bridges or the like) at all times. Further areas of application are also plausible for RecceMan, for example, medical diagnosis or criminal analysis.

In its current configuration, RecceMan is based on research performed by the Fraunhofer IOSB in the field of image exploitation and assistance systems. This research will be continued in order to improve the quality of RecceMan in the future, that is, by assisting the image analyst in his analysis of infrastructure (e.g. airports, harbors and industrial plants).

User-friendly editors are provided for creating feature trees and profiles and also allow the user to update data sets.