Deutsches Zentrum für Luft- und Raumfahrt

Handout

DriveMark®

High precision mapping for automated vehicles via remote sensing

DriveMark provides Ground Control Points (GCPs) with coordinates via remote sensing data with an accuracy within the cm / inch level.
Benefits are cost reduction, high area coverage and process simplicity for new navigation applications.
Key activity is the development of efficient methods for the generation of ortho rectified aerial images as base for new digital maps for highly automated and autonomous driving – which comprises the initial data generation towards refinements and current updates. The innovation character is the intelligent combination of optical images and radar satellite measurements.
DriveMark contains the ongoing validation of the method as well as the software processor development.

The innovation project co-funded by German Helmholtz Association has been started at German Aerospace Center (DLR) in 2014. It is aiming for high precision ("geodetic") mapping of the road network with its functional objects as a core activity within EO4Car®.
Performing corrections for atmospheric and ionospheric path delay as well as solid Earth tides we come to a similar range of geolocation accuracy, as with GNSS techniques. DriveMark enables our business partners to produce digital road maps with satellite remote sensing and Earth observation (EO) data; it is not necessary anymore to perform in-situ measurements.
Future work is heading towards the extraction of relevant features like lane markings and guard rails as well as precise ego-positioning of the car using land marks.
The aim will be achieved by the fusion of the high definition road maps generated with remote sensing and surrounding data gathered by the car sensors. This provides a comprehensive picture where the car is exactly located on the road including its orientation ("attitude").
The method works independently from GNSS, which is a need for precise navigation in cities as well as for autonomous driving.

The precise maps and ego-localisation opens new opportunities for detecting changes along the road (e. g. due to construction) by a continuous comparison ("cross-check") with the road data captured via the on-board sensors of cars. Changes will be reported to a backend server; according to the street data detected by the fleet of cars "24/7everytime everywhere", the map can be kept up to date "as is". In this way the digital data base can be "healed" and relentlessly improved by means of crowd sourcing. This process leverages the day-to-day use value of the spatial knowledge and creates the best fit for various existing and new fields.

Developments & Outcome

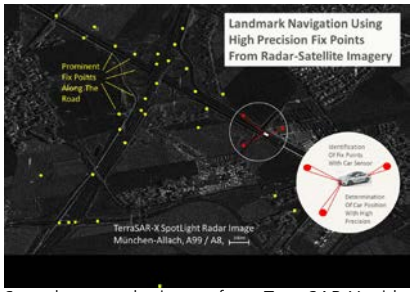
- SAR Geodesy Processor
- GCP Ground Control Point Detector
- Optical Co-Registration Processor
- Validation campaign incl. accuracy analysis
- Sample data set for testing

Key Benefits (USP):

- Hi-end geometric precision
- Wide area coverage
- Worldwide applicable
- Remotely – contactless – and repeatable
- Consistent & comparable data across boundaries
- Independent from GNSS
- Initial map generation & updates
- Highly automated processing
- Enrichment of existing Geo data base archives by reprocessing

Target users

- Remote sensing companies
- EO value adder
- Navigation maps provider
- Car manufacturer (OEM)
- Automotive 1. tier supplier
- Sensor development specialists



Spaceborne radar image from TerraSAR-X with high-lighted land marks like traffic signs in yellow.
A map with the landmark positions with cm / inch-precision is available in the car, which uses its onboard sensors to triangulate the pass points in order to determine its own position.

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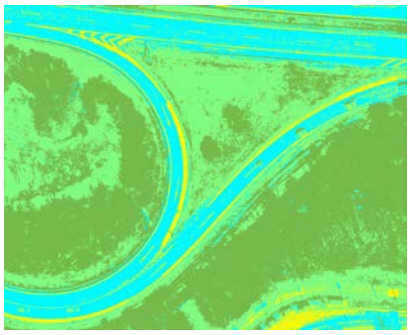

False color aerial image showing an exit of a German motorway.

The absolute coordinates of all road marking lane boundaries will be provided.

DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8.000 employees at 16 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Goettingen, Hamburg, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

DLR's mission comprises the exploration of Earth and the Solar System and research for protecting the environment. This includes the development of environment-friendly technologies for energy supply and future mobility, as well as for communications and security. DLR's research portfolio ranges from fundamental research to the development of products for tomorrow. In this way, DLR contributes the scientific and technical expertise that it has acquired to the enhancement of Germany as a location for industry and technology. DLR operates major research facilities for its own projects and as a service for clients and partners. It also fosters the development of the next generation of researchers, provides expert advisory services to government and is a driving force in the regions where its facilities are located.

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