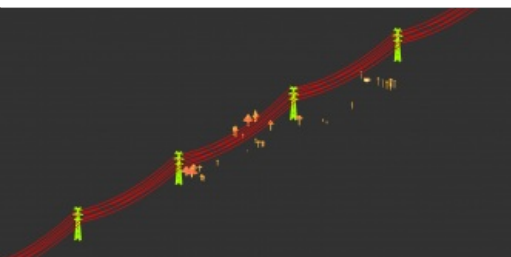


Producing High-quality 3D Maps from Lidar



DIPPER, a spin-off company from the University of Twente, provides a breakthrough solution for processing massive amounts of Lidar data accurately and efficiently. It offers comprehensive services related to Lidar data processing and 3D scene modelling. Since the self-developed software is highly automated, one operator working with DIPPER on one laptop can create high-quality 3D maps for

10,000 buildings within just one week – equivalent to at least ten times faster than normal. The high efficiency and accuracy boost large-scale applications such as asset management, smart city, securities development and urban planning. So far, DIPPER has successfully created 3D models for five international cities.

What is Lidar?

Lidar is a remote sensing technology that measures distance by illuminating a target with a laser and analysing the reflected light. It is able to create intricate three-dimensional maps in places where bad weather or thick vegetation hamper traditional aerial mapping. In addition, an airborne Lidar system provides 3D data with 5cm accuracy in the vertical direction, which is much better than the 50cm accuracy achieved by dense matching from stereo images. However, current Lidar data processing involves intense manual work, making it very expensive and time-consuming. Ultimately, most companies on the market are either offering accurate 3D maps at high prices or producing affordable 3D maps with compromised quality. Therefore, it becomes extremely difficult to achieve advanced Lidar applications.

DIPPER

DIPPER, a spin-off from the University of Twente (UT), was founded in December 2014 in Enschede, The Netherlands. Supported by a top research group on Lidar mapping, [DIPPER](#) has successfully converted 20 years of pioneering scientific achievements into commercial products. The company has developed novel algorithms which enable ultrafast and highly automated data processing. Meanwhile, it also provides reliable 3D ICT services including solar energy calculation, flood control, noise simulation and sensor layout design. With its unique technology, competence and flexibility, DIPPER can provide customised products and services according to the situation, application and requirement.

Level of Detail

DIPPER's technology can significantly improve efficiency by creating high-quality 3D building models with a remarkable degree of automation. The quality levels of 3D maps can be determined by how many details they provide. At Level of Detail 1 (LoD1) buildings are reconstructed in just one height, which leads to all the building models being displayed with flat roofs. In comparison, at Level of Detail 2 (LoD2), the roof constructions including dormers can be clearly modelled in 3D. Considerable effort is needed to improve the level of detail from LoD1 to LoD2. The DIPPER software can construct 3D building models at LoD2 using Lidar data collected from a helicopter or an aircraft. During the data processing by the software, the Lidar points on buildings are firstly recognised and segmented into individual roof faces. The roof structures are then inferred and primitive sub-buildings are detected and modelled. More impressively, if an error is discovered in the roof construction, the software is able to automatically recognise and memorise the error patterns, and then correct repeated errors in other buildings models. Therefore, this algorithm ensures the high quality of the 3D model.

3D is booming

The 3D map application market is currently booming. The international market reached USD1.90 billion in 2015 and is predicted to increase to USD16.99 billion by 2020 at an estimated CAGR of 55.0%, according to market research company M&M. From a regional perspective, the Dutch government is developing its national service for large-scale 3D topography. Cities like Amsterdam, Rotterdam and The Hague have launched projects to invest the application of 3D maps for city visualisation, management and communication. Moreover, companies focusing on solar energy, insurance, security and city planning are increasingly using 3D information for business development and information support purposes. Accordingly, the demand for affordable and accurate 3D Lidar processing and modelling is growing fast, and DIPPER is ahead of this trend.

Lidar Data Processing

In 2015, DIPPER developed advanced toolkits for Lidar data processing. One important function of the toolkits is to model the urban scene, such as buildings, terrain, power corridors and trees, with high efficiency and accuracy. This means that DIPPER is able to combine 3D building models with environmental parameters and provide detailed overviews and smart suggestions for many advanced applications, including solar energy analysis, noise management, flood control and urban planning. Meanwhile, DIPPER has established close connections with many government organisations in both The Netherlands and China, including Dutch Kadaster, municipalities and utility firms; so far DIPPER has made high-quality 3D maps for five Dutch cities and a Chinese power firm. Supported by these achievements, DIPPER is also exploring business opportunities within non-governmental organisations such as solar panel companies, insurance companies and the LoRa Alliance for the Internet of Things.



Figure 2. A 3D scene of a very-high-voltage transmission line in China showing pylons, power lines, buildings and trees. A 3D map of a transmission corridor can be used in vegetation clearance management, risk management and new plan design.

Transforming Lidar into 3D

“Our aim is to provide easy-to-use applications. We are transforming massive Lidar data into semantic and concise 3D vector data,” says Biao Xiong, DIPPER’s CEO. After completing his PhD degree at UT, Xiong launched the start-up with four passionate colleagues: “We have successfully processed Lidar data for city, forest, railway, power corridor and industry scenes. The data processing varies from multi-scan registration and point cloud classification to 3D scene modelling. Since we work closely and effectively in a flexible environment, we are able to respond quickly to the challenging problems raised by customers every day. As DIPPER’s slogan is ‘Showing, Solving and Leading’ and that perfectly sums up what we are trying to achieve, i.e. to show a new view of the world via 3D Lidar maps, to solve complex problems and help with smart decision-making by developing toolkits, and to lead Lidar processing technology by keeping innovation alive. Moreover, as an innovative company aiming to build a bright future, DIPPER is also willing to contribute to the development of new concepts such as self-driving cars and smart city development.”

Countrywide 3D Map

In 2016, DIPPER will make a detailed 3D map of the whole of The Netherlands from airborne Lidar data. It will be the world’s first countrywide 3D map at LoD2. Over the next five years, DIPPER is planning to work with other pioneering countries that are eager to obtain accurate 3D maps. As an innovative company, it will continue to invest in research and development to improve the software and workflow and to applying cutting-edge technologies including deep learning, big data mining, cloud processing for automatic interpretation and 3D modelling.

<https://www.gim-international.com/content/article/producing-high-quality-3d-maps-from-lidar>
