Application of Vector-based Occlusion Detection Method for Ortho-image Generation of a Bridge

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The defects, such as cracks, of bridges will threaten the safety of road occupants Thus, it is essential to detect those defects of bridges, and take actions against them. However, it will cost a lot of money, time and manpower to detect by human. There are automatic methods, such as creating 3D bridge models with images, which can help recreate bridges with texture. Nevertheless, the texture of the 3D model is not sufficient and precise enough to perform defect detection. Besides, due to the incorrect scale of the texture of bridges, the texture cannot be used to evaluate the content of the defects. Therefore, we try to build the 3D CAD model of a bridge composed of polygons first, and make orthoimage of each polygon. Since orthoimage have the characteristic of uniform scale, it can present the correct conditions of bridge surface.

In this research, we construct numerous polygons with geo-spatial coordinates to present the model of a bridge. After that, we take pictures of the bridges by UAV and use them to make orthoimages of the model. During the image acquisition, occlusion of some parts of the bridge will occur. Thus, it is important to detect those occluded areas and replace them with correct texture. The methods of detection used in this research is a vector-based occlusion detection method, which is used to determine whether a polygon is occluded by other polygons in an image by describing the relation between two polygons. After the detection, we can calculate and record the coordinate of the occluded areas to make further processing, such as determining a master image that have the least deformation, highest spatial resolution with minimal occluded area, and later replace the occluded areas with other slave images.

After the detection process, the polygons of the models that have occlusion need images with different perspective to make the texture of the occluded area. Since multiple images are used to make a complete orthoimage, which may cause the composite texture to have gray value discontinuity or contrast, it is necessary to correct them furthermore. Thus, methods including image enhancement and seamless blending are applied to make the orthoimage has consistent photometric texture.

The result of the model with correct texture is then created, and it can be further used for detecting defects of bridges by not only human eyes but also artificial intelligence.

Keywords: Occlusion Detection, 3D Model, Orthoimage