

Image inpainting for applications in the field of terrestrial laser scanning

Graduate



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Initial Situation: Terrestrial laser scanners (TLS) utilize lasers to create a point cloud of the environment. These point clouds find diverse applications in fields such as surveying, architecture, construction, archaeology, forensics, film, and the gaming industry. Points are colored using camera information, resulting in a realistic 3D model of the environment. Laser scanners in which the optical center of the laser distance measurement unit and the camera are not identical face a parallax issue. The emitted laser beam captures points that the camera cannot (parallax shadow), resulting in images without valid color information (ground truth). This investigation determines whether these images can be improved using Deep Learning Image Inpainting methods.

Approach / Technology: Replacing missing or damaged parts of images with new information (Image Inpainting) may be achieved through modern neural networks, which necessitates research into state-of-the-art inpainting methods and associated networks. A demonstration application is developed using Python to visually present and compare the outcomes of various methods. The potential and limitations of each method are examined using synthetically generated and real-world scenarios. Results are summarized in a report and compared with classical inpainting methods.

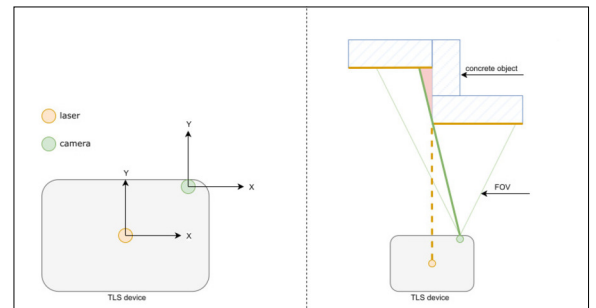
Result: The results are objectively evaluated, to the extent possible, by comparing a Structural Similarity Index (SSIM) metric, which measures similarity of images. Since ground truth is unavailable for real-world scenarios, these scenarios can only be subjectively assessed. The investigation concludes that classical methods perform better for artificially generated examples compared to neural networks.

For real images, neural networks perform at least as well, if not better. The results clearly show where the advantages and disadvantages of the neural networks lie compared to the classical methods.

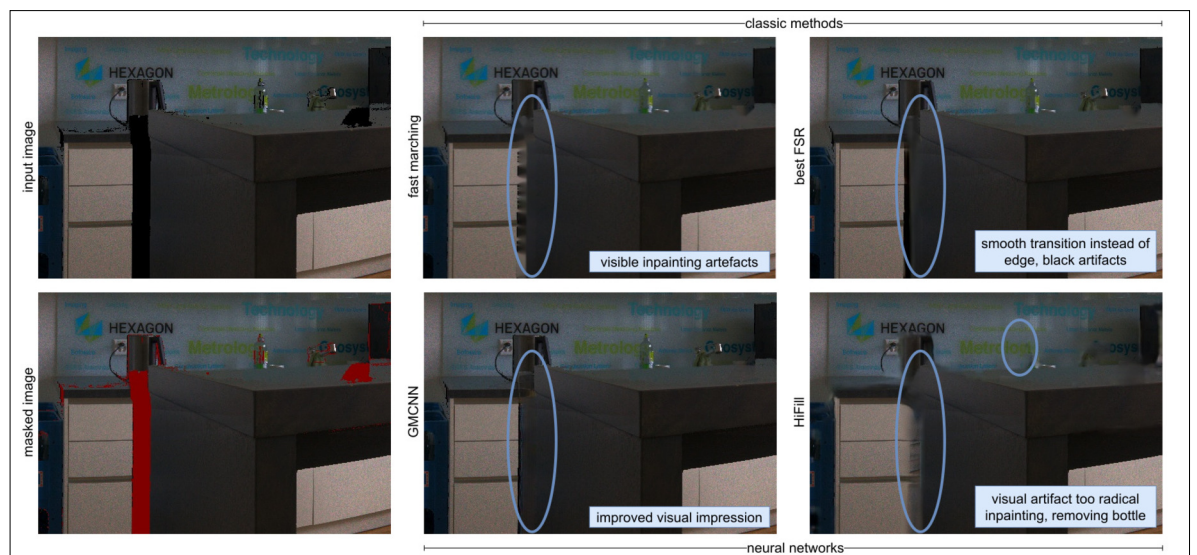
Leica RTC360
Leica Geosystems



Parallax issue of a laser scanner in the context of TLS
Own presentation



Original image, original image masked with parallax shadows (red), results of the various inpainting methods
Own presentation



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