High Quality Mosaics from UAV Obtained Images

Technology No. 20160088

IP Status: Issued US Patent; **Application #:** 15/415,347

Improved agricultural mosaic and 3D model reconstruction

Large scale mosaics are constructed by stitching together images obtained from unmanned aerial vehicles (UAVs) flying at low altitudes. This novel method generates improved image mosaics by using overlapping images of a landscape after determining a three-dimensional plane of interest and warping the overlapping images onto that plane to form a mosaic. The process begins by dividing a geographical area into block areas and analyzing several images of each area. Next, the algorithm selects the best image for each location and then independently rectifies each image to obtain the corresponding portion of the mosaic. The novel technique avoids costly joint-optimization over the entire sequence and is validated using challenging input sequences motivated by agricultural applications. The method has recently been extended for 3D point cloud reconstruction and semantic feature extraction.

MN-IP Try and Buy

Try

- Trial period is up to 12 months
- Trial fee is $5,000 for twelve months
- Trial fee is waived for MN companies or if sponsoring $50,000+ research with the University
- No US patent expenses during trial period

Unique algorithm reduces computational burden

Precision agriculture currently uses image analysis that is inaccurate or requires too much computing power/time to be fast enough for farmers. Stitching together numerous homogeneous landscape images is a challenge. Existing image stitching/mosaicking methods rely on inter-image homographic computation based on a planar scene assumption for images taken from high altitudes. These methods also avoid scale and resolution changes by relying on primarily translational motion at fixed altitudes. This new approach overcomes these limitations and performs well even with aerial images taken from low altitudes by a UAV performing complex motions. The algorithm creates ground geometry from a small sample of images, uses the highest quality images to match images to the ground geometry and achieves an accurate field map without the computationally intensive process of stitching images together. It can accommodate a large number of images because the joint optimization required for robustly estimating the world structure is performed on a very small fraction of the images, yet all images in the input sequence are used and a novel method chooses the best image for each ground patch.

Phase of Development

- Prototype developed

Benefits

- Provides useful information for agricultural managers
- Faster than existing stitching methods
- Less computationally intensive

Features

- Accounts for dynamic movement and altitude variability
- Enables navigation of ground based robots/drones through crop rows
- Can use aerial images taken from low altitudes

Applications

- Corn and soybean crops
- Precision agriculture

Researchers

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Publications

Large Scale Image Mosaic Construction for Agricultural Applications

IEEE Robotics and Automation Letters, Volume: 1, Issue: 1, Jan. 2016

Adaptive View Planning for Aerial 3D Reconstruction of Complex Scenes

Computer Vision and Pattern Recognition (cs.CV), arXiv:1805.00506 [cs.CV]

View Selection with Geometric Uncertainty Modeling

Computer Vision and Pattern Recognition (cs.CV), arXiv:1704.00085 [cs.CV]

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