Report of attending ISPRS Technical Commission III Midterm symposium on Photogrammetric Computer Vision 2014

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Photogrammetric Computer Vision 2014

The Photogrammetric Computer Vision (PCV) conference, organised by Technical Commission III ISPRS, takes place every four years. Held in Zurich this year, the conference accepted 83 papers, includes 27 Annals from double-blind review and 56 Archives. One particular feature of the PCV 2014 is that the conference is in conjunction with the European Conference on Computer Vision (ECCV), one of the top conferences in computer vision. This gave good opportunities for researchers in photogrammetry and computer vision groups to exchange research ideas and discuss some cutting-edge topics. I was grateful to ISPRS Foundation for giving me travel grants for attending PCV conference and present some of my PhD research.
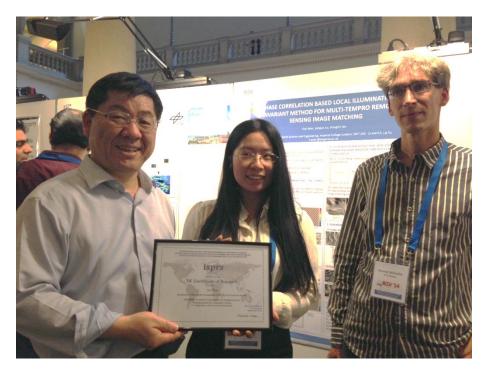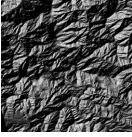

Figure 1 Travel grants handed by Jun Chen, president of ISPRS Council and Konrad Schindler, program chairs of PCV 2014.

I was particularly keen on the research of image matching using multiple sources images in the PCV and ECCV conference. Traditional photogrammetry is based on stereo images which taken from the same sensor with a fixed base-line, however, a number of new sensors have been developed these years, for example Cube satellites, Unmanned Aerial Vehicles (UAV), planetary rovers and even smart phones. The capability of multi-source image matching enables wider applications of remote sense data. I was inspired by the oral session 4 'Pose Estimation' which comprised web-shared landscape image matching [1], automatic marker-based geo-referencing using UAV images [2] and geo-referencing of heritage using old analog aerial photographs [3].

My poster at PCV 2014

Within the poster session, I presented some of my PhD research titled '*Phase Correlation Based Local Illumination-invariant Method for Multi-temporal Remote Sensing Image Matching*'. This paper aims at image matching under significantly different illumination conditions, especially illumination angle changes, without prior knowledge of lighting conditions. We proved the robustness of Phase Correlation (PC) towards local illumination variation, and then generated a disparity map (shown in Figure 2(c)) from multi-illumination angle stereo pairs as illustrated in Figure 2(a) and (b) that disparity maps demonstrated high fidelity to the original DEM, Figure 2(d), and the Normalised Correlation Coefficient (NCC) between the two is 0.96. A DEM generation experiment was carried out using an aerial image from Bluesky (Figure 3(a)) and a Geoeye satellite image (Figure 3(b)) of Cranfied, UK, under different solar illumination conditions. Figure 3(c) is a 3D perspective view of draping the aerial image on the generated disparity map, which shows that the PC matching algorithm is quite robust to reconstruct the overall 3D terrain surface correctly from this multi-sensor/season non-conventional stereo image pair though there are considerable errors in area of trees that change greatly in different seasons.
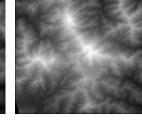

(a) Winter   (b) Summer   (c) Disparity map   (d) Original DEM

Figure 2 Disparity map generation from winter and summer terrain shading images
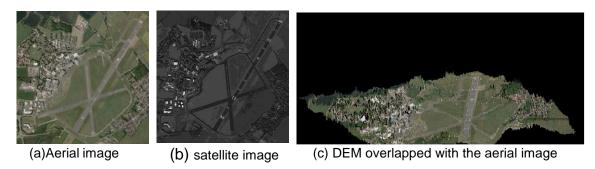

(a)Aerial image   (b) satellite image   (c) DEM overlapped with the aerial image

Figure 3 DEM generation from multi-source remote sensing images

Conclusion

I think the PCV 2014 is well-organised and informative. Particularly, I found the conjunction with ECCV very helpful to me, because it offered a great chance to know the latest technologies in computer vision and get to know people from different research groups.

This is my second time to participate PCV conference. I attended the last PCV conference in Paris in 2010 when I was an undergraduate student. After four years, I am now a PhD student in Imperial College. It is an invaluable experience for me to meet old friends and get to know new friends in PCV. I hope I can attend PCV and other ISPRS conferences in future.

Reference

[1]   T. Produit, D. Tuia, V. Lepetit, and F. Golay, "Pose Estimation of Web-Shared Landscape Pictures," *ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences,* vol. 1, pp. 127-134, 2014.

[2]   M. Rumplera, S. Daftryab, A. Tscharfc, R. Prettenthalera, C. Hoppea, G. Mayerc*, et al.*, "Automated End-to-End Workflow for Precise and Geo-accurate Reconstructions using Fiducial Markers," *ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences,* vol. 1, pp. 135-142, 2014.

[3]   I. Cléri, M. Pierrot-Deseilligny, and B. Vallet, "Automatic Georeferencing of a Heritage of old analog aerial Photographs," *ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences,* vol. 1, pp. 33-40, 2014.