



CEOI SuperRes-EO: Super-resolution restoration from multi-angle EO imagery

Earth Observation Showcase

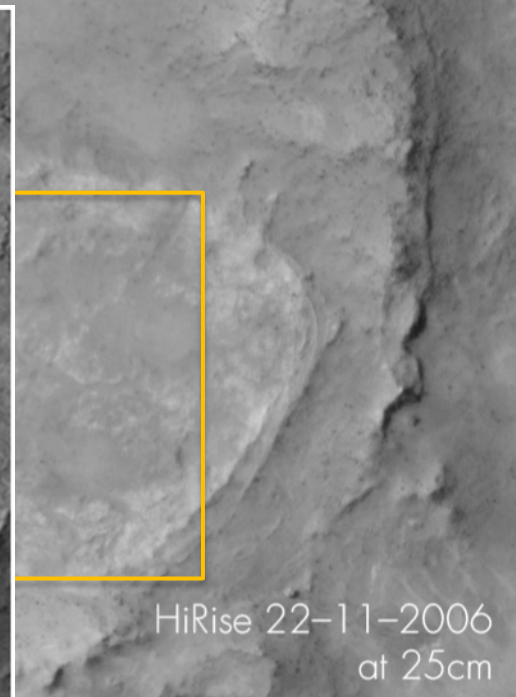
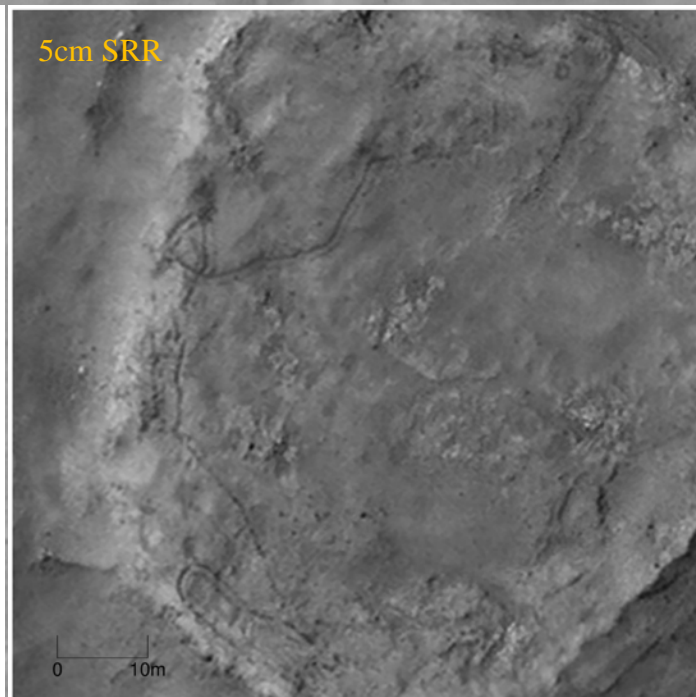
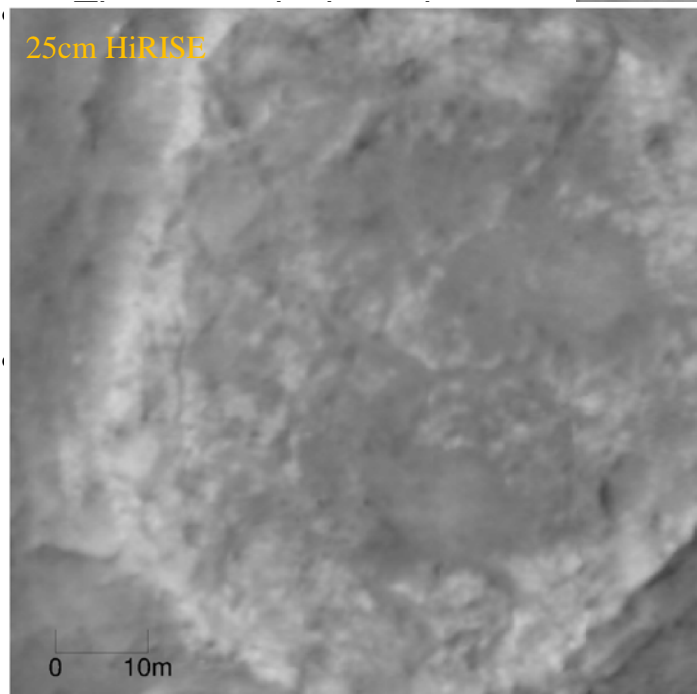
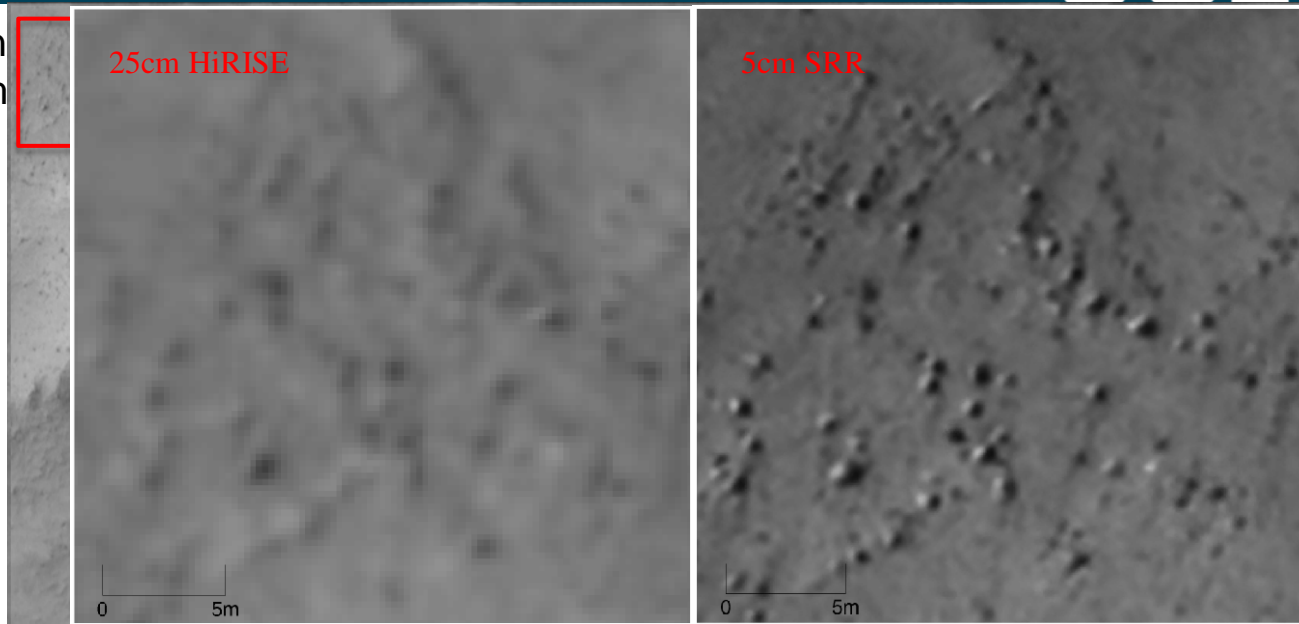
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UCL-MSSL in collaboration with SSTL and UrtheCast

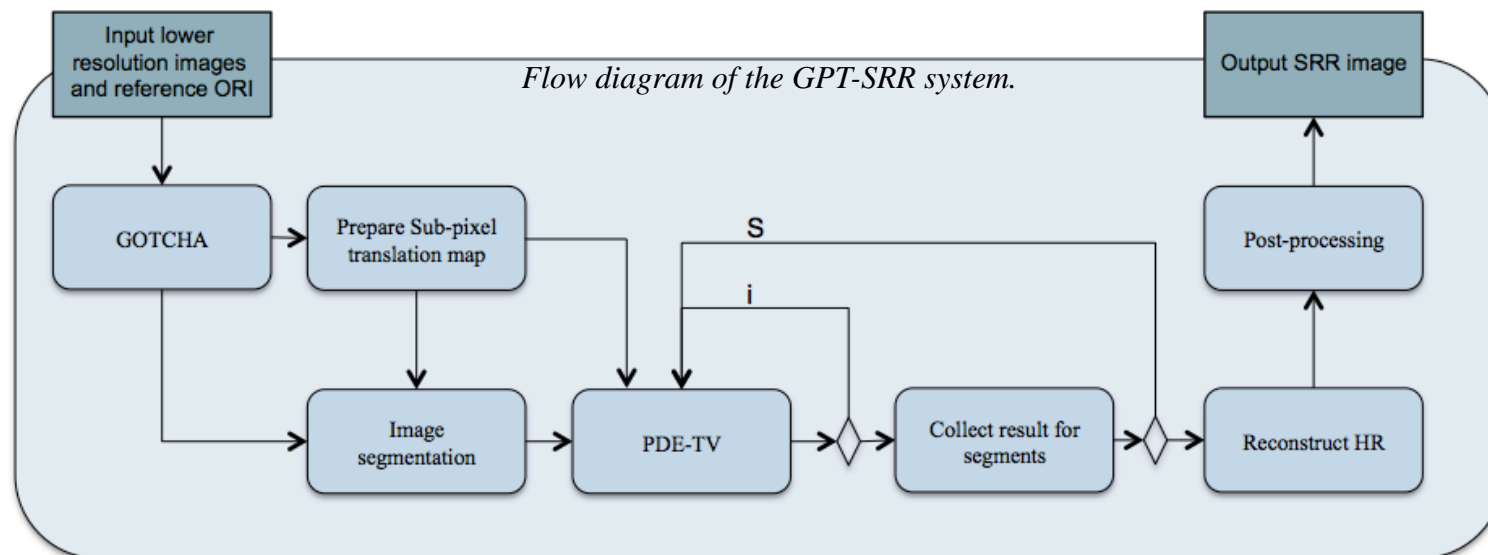
26 Oct. 2017

5cm SRR from 8 repeat-pass 25cm HiRISE images

- An unique Super-Resolution Restoration (SRR) algorithm was developed initially for application to Mars images.
- SRR has been applied to HiRISE (25cm) repeat-pass images to yield resolution enhancements of between 2-5 times (SRR=5-12.5cm)
- SRR included confirmation of location of Beagle2 lander.



- Inputs multiple overlapping lower resolution images and a reference orthorectified image.
- Generates sub-pixel motion vectors (down to 0.01 pixel) using Mutual Shape Adapted Scale Invariant Feature Transform (MSA-SIFT) ¹ and Adaptive Least Squares Correlation (ALSC) and region growing (Gotcha) ².
- Resolves 4th order Partial Differential Equation (PDE) based Total Variation (TV) prior in segmented tiles and collects the results for all high resolution segments to reconstruct the SRR image at finer resolution ³.
- The GPT-SRR technique is optimal for orbital imagery because it uses both marginal information from pixel shifting (limited to 1.75x enhancement) but also restores distorted features onto an orthorectified grid from comparatively large viewing angles, thereby achieving a 2-5x enhancement in resolution.





- SRR results with 12 multi-angle 4m UrtheCast® Deimos-2 images to achieve a 1-2m restoration.
- After algorithmic optimisation, camera and sensor modelling, and GPU porting, we aim to achieve an enhancement factor of 3 to 4 in a fraction of the time.



Thank you for your attention!

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