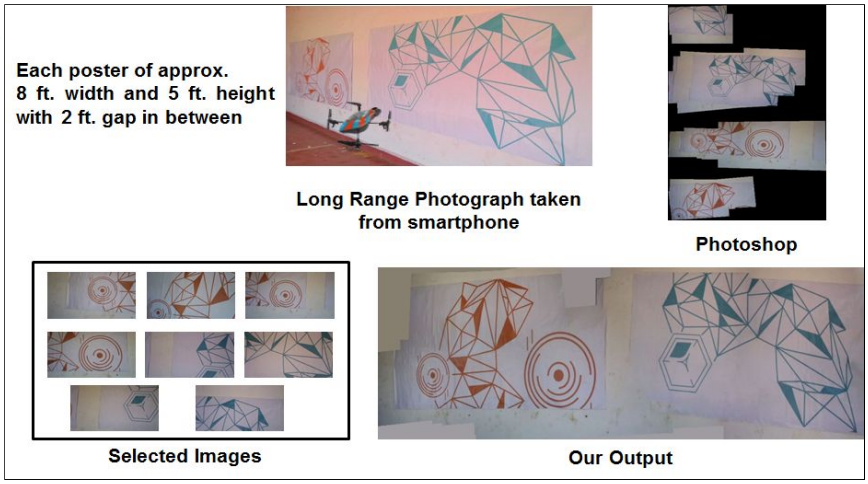
Exploring with the eyes of a quadcopter

Mosaicing of scenes using quadcopter and failure cases with Photoshop. Photoshop is confused with vacant spaces, and repeated features and it does not know how to stitch. Notice how in our output, we are able to get a frontal image of the design.



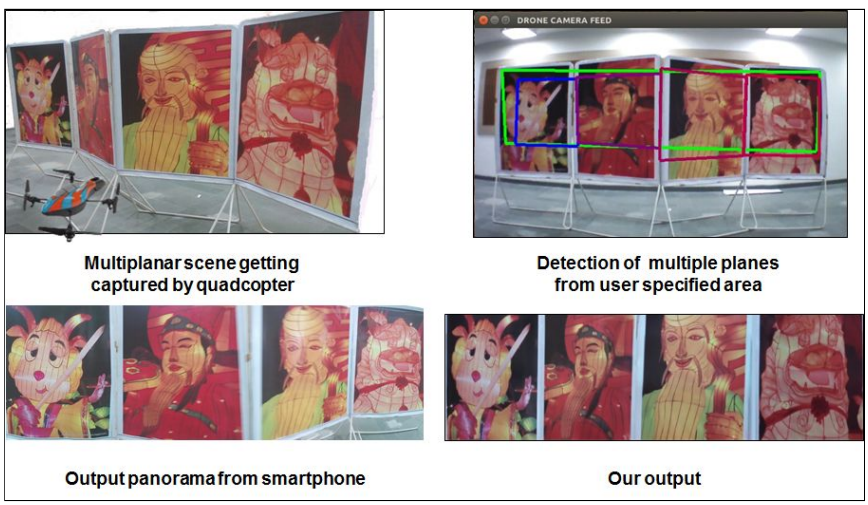
While digital imaging has taken the world by storm, there are many trying situations when it is quite difficult to take pictures from a smartphone or a handheld camera. One of the scenarios where we may consider using a drone for imaging is to capture a panorama of an extensive building, or when an inspector wants to examine defects in, say, the iconic Worli Sea Bridge.

While panoramic mosaicing is a 'solved' problem, a research problem arises if there are gaps in the data e.g. with very few 'features' between the steel girders (only the sky or the horizon is seen). Existing panoramic mosaicing techniques fail. In our work, we focus on methods to construct panoramas from the scenes captured through quadcopter having significant regions of vacant spaces.

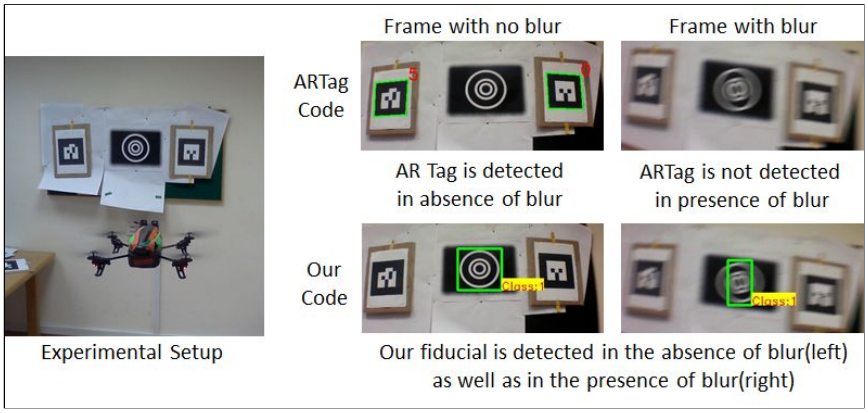
First, the captured video contains a large number of images - these are *summarised* by our algorithm to get a small set of images that will encompass the complete scene under interest. These images when placed at proper positions using the IMU (Inertial Measurement Unit) data present on the quadcopter will provide a final mosaic. We demonstrate the efficacy of our approach on a number of input sequences that cannot be mosaiced by existing methods.

A big problem with current day devices is power. Due to limitation of battery and time required to cover scene in detail, we may not be able to image large scenes using just a single quadcopter. In such cases we use multiple quadcopters that image large scene collaboratively. We divide the scene in

Mosaicing of multiplanar scenes through quadcopter. If we use smartphone for taking panorama of multiplanar scene, we get distorted output as shown above. Instead we detect multiple planes and mosaic each plane independently and then join each mosaic.



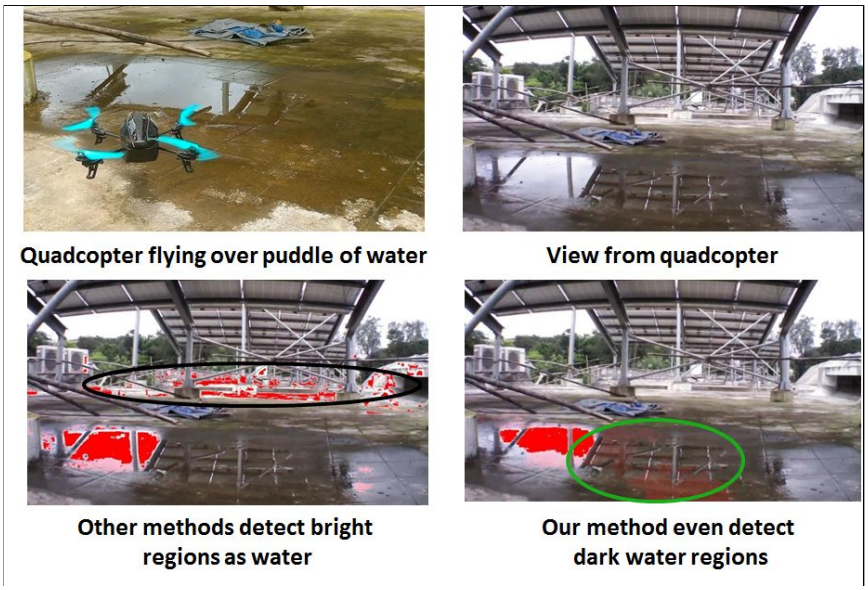
Design and detection of blur resilient fiducial. Popular fiducials like AR Tag are not detected in the presence of motion blur which is common in case of images captured from jerky quadcopter. But, our fiducial is getting detected as well as code in that is correctly classified in the presence of motion blur.



multiple parts and each part may be covered by one quadcopter. In this scenario every quadcopter should identify every other quadcopter in reliable manner. This can be achieved by placing *fiducials* on quadcopters. Fiducials are commonly placed in environments to provide a uniquely identifiable object in the scene. But, current fiducials such as ARTag (https://en.wikipedia.org/wiki/ARTag) are not designed to handle blur which is introduced due to jerky motion of inexpensive quadcopters. We have designed blur resilient fiducials. So, not only each quadcopter can identify other quadcopters, one may even instruct each quadcopter according to code embedded in the fiducial on it.

While imaging for personal consumption or inspection has its uses, we also considered an important public health issue. In recent times, there has been a sharp increase in dengue and malaria, especially in urban areas. One of the major reasons for this health hazard is the number of locations where one can find stagnant water ('chajjas' and split ACs make a potent combination in hot areas, and there's plenty of water during the rainy season!) These locations are large breeding grounds for fast multiplying mosquitoes, and other insects. Other areas include traditionally uncovered gutters, and also terraces of high rise buildings – areas that are hard to reach and access. We propose the use of a quadcopter to inspect areas and identify stagnant water patches using a novel technique based on optical flow.

Stagnant water detection through Quadcopter. State-of-the-art method wrongly detects bright regions as water regions. Our method robustly detects the stagnant water. The confidence measure in detected water is shown by the amount of red tinge.



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