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GyroStabilizer, GyroStabL

- Android applications for deblurring of photos with motion blur based on onboard gyroscope sensor measurement

Both apps work as an enhanced camera with a preview shown on the display. When clicked anywhere on the display, autofocus is performed, a picture is taken and then an optional tuning of various deblurring parameters may take place.

Quality of the results depend highly on good camera-gyroscope synchronization and because of the lack of Android API support (mainly in pre-Lollipop versions), manual tuning was sometimes needed. It's achieved by a simple slider with a preview, which can be activated in the app settings (`Enable preview` in `Synchronization tuning` section). After a photo is taken, you can use the slider to find the corresponding motion sensor events for the acquired image. A small B/W preview of the resulting deblurred image is calculated in real time and a trajectory of the motion (which should correspond to trajectories of point lights in the image) is displayed on top of the preview. You can drag the image to see the preview for a different position on the image.

There is also a problem of gyroscope sensor drift, which can be limited by calibrating the zero-rotation values (in Settings). However, the calibration values are not very stable and so we tried other means to fight this problem (different in both apps, see later).

After the deblurring process is completed, the resulting JPEG image is displayed in the internal viewer. Standard pinch-to-zoom and drag gestures are supported. To see the effect of the deblurring, the original image is displayed instead of the result whenever you touch the display.

There is also a gyroscope testing mode for visualizing gyroscope measurement, which is activated by Mode menu item. A virtual point in the scene is tracked using rotation measurements and drawn on top of camera prveiew as a connected line.

GyroStabilizer

- older app, tuned for Samsung Galaxy S2 (good camera-gyroscope synchronization is calculated from camera driver log), timing might not be accurate on different models
- Special per-photo calibration can be used (`Drift correction` in settings). If selected, the phone first waits for a still position (indicated by a purple display border), then the measuring starts (green border, gradually going to black) and when it's done (white border), the phone is ready to take a picture as normal – touch the display to autofocus & capture the photo. Once you pick up the phone (border changes from white to black on the first move), the photo should be taken as quickly as possible. Just after the shutter is closed, a second round of gyroscope measurement will take place in the same manner as the first one. Put the phone down to a still position and wait until the measurement is done (purple border until no rotation detected then green and changing to black). Then the deblurring will continue as usual, with gyroscope zero-values adjusted to correspond to linear interpolation between the two calibration measurements.

GyroStabL

- Android 5 (Lollipop) required, uses newer camera2 API to make use of more precise timing and manual settings abilities
- Gyroscope drift is handled by manual tuning in this version for testing purposes. It's active when the synchronization tuning and manual gyroscope drift (`Enable preview, Drift correction` in settings) are switched on. After the image is captured, the deblurring preview is shown as before, but the gyroscope drift can be altered by sliding over the preview window. Horizontal/vertical movements change X/Y values, Z value can be changed by a two-finger rotation gesture (just remember that the first touch has to start on the preview window to change the drift values). The numeric values of the assumed gyroscope zero-values are shown on the display and the deblurred preview is recomputed in real time to accommodate both the gyro drift and synchronization delay.
- There is also an option for a multi-image capture with motion sensor recording (`Create sequence` and `Sequence size` in settings). However, deblurring is not yet ready in the device, but there are some Matlab scripts prepared for testing this feature (`deblurMulti.m`).