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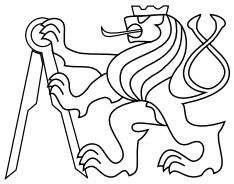

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ANNEX 6

Localization Using SVAVISCA Panoramic Images of Agam Fiducials - Limits of Performance

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Abstract

We study what are the limits of the use of SVAVISCA panoramic images of Agam fiducial for a localization of an observer. Experiments show that SVAVISCA panoramic images of resolution 110×252 pixels can be safely used to localize the observer up to the distance two meters between the observer and the fiducials used. For distances larger than three meters, the projection of fiducials becomes too small to allow for extracting localization information.

1 Introduction

In this report we study the limits of the use of SVAVISCA panoramic images of Agam fiducials [1] for a localization of an observer.

The aim is to determine how far observer can be from a fiducial before the localization breaks down. The distance is primarily determined by the size of fiducial projection into SVAVISCA panoramic images. If the projection of a fiducial becomes too small, the localization information, which is the average brightness in fiducial squares, is lost. The following experiments show when this happens.

2 Experiment

The experiments were performed in exactly same way as the ones described in [1]. The reader is referred there for more details about the experiments. Only result of the same experiments on different sets of images are shown here.

Figure 1 resp. Figure 2 show the intensity profiles in fiducial squares as a function of the image number. The images were taken along a linear path with the step equal 20 cm. The line of motion was at the distance one resp. two meters from the fiducial. The graphs (e–h) clearly show that the localization will work for a conventional as well as for a SVAVISCA camera.

Figure 3 shows three images taken along a linear route in the middle of a room. There are five fiducials in the room. Four of them were used in the experiment. The fiducials used are numbered in the figure. The room is roughly 7×7 meters large. The journey was done from the fiducial number one towards the fiducial number four along a straight line with the spacing between the images equal roughly 40 cm.

Figure 4(a) resp. 4(c) show the average intensities inside the squares of the fiducial number one as a function of the image number for a conventional resp. a SVAVISCA camera. Figure 4(b) resp. 4(d) shows the ration of intensities as a function of the image number for conventional resp. SVAVISCA camera. The image number 7 was corrupted during the transmission via a wireless link and the image number 12 was missing completely. We can see that all images that were available produced reasonably constant intensities as expected. The computed values are more reliable at the beginning of the

sequence because the observer is closer to the fiducial number one there and thus the fiducial is projected into a larger area.

Figure 5 shows exactly the same graphs as Figure 4, only for the fiducial number four in this case. However, here the more reliable values should be obtained at the end of the sequence where the observer is closer to the fiducial number four.

Figure 6 resp. Figure 7 show the same graphs for the fiducials number two and three respectively. The distance of the line along which the observer moves is about 4 meters to the fiducial number two and 3 meters to the fiducial number three. We can see that while the localization might still work for a conventional camera, it would certainly break down for the SVAVISCA camera because of insufficient resolution.

3 Conclusions

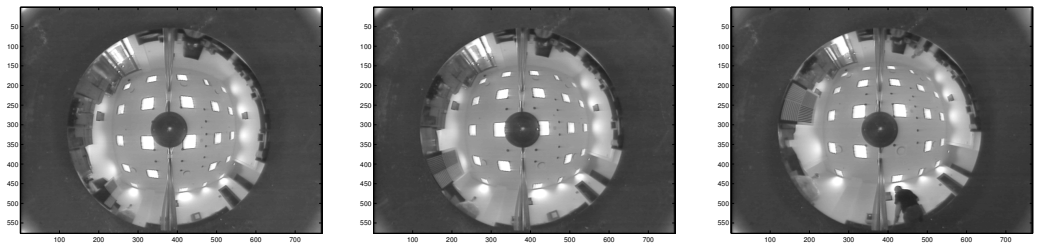
The experiments show that localization can be done in a room of the size 7×7 meters using four fidusials if images from a conventional camera were used. Localization from SVAVISCA images could safely be done in a room of size 4×4 meters.

Acknowledgements

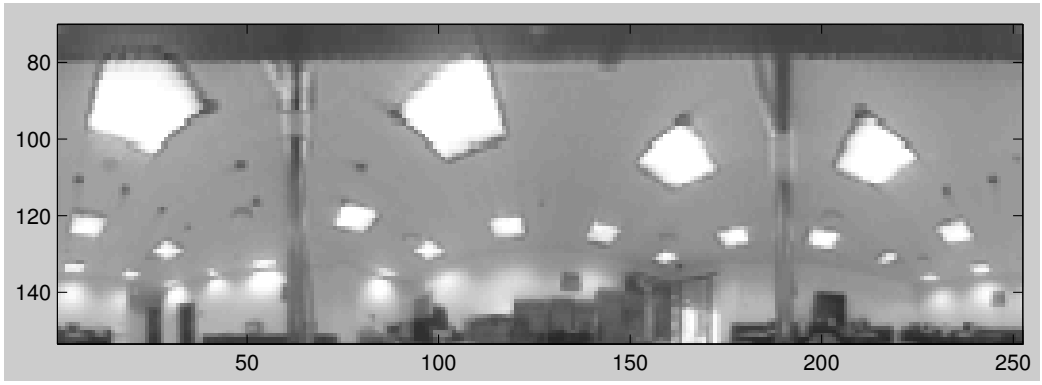
The original images of Agami fiducials were kindly provided by D. Livshitz and A. Bruckstein from Computer Science Department of the Technion in Haifa, Israel.

References

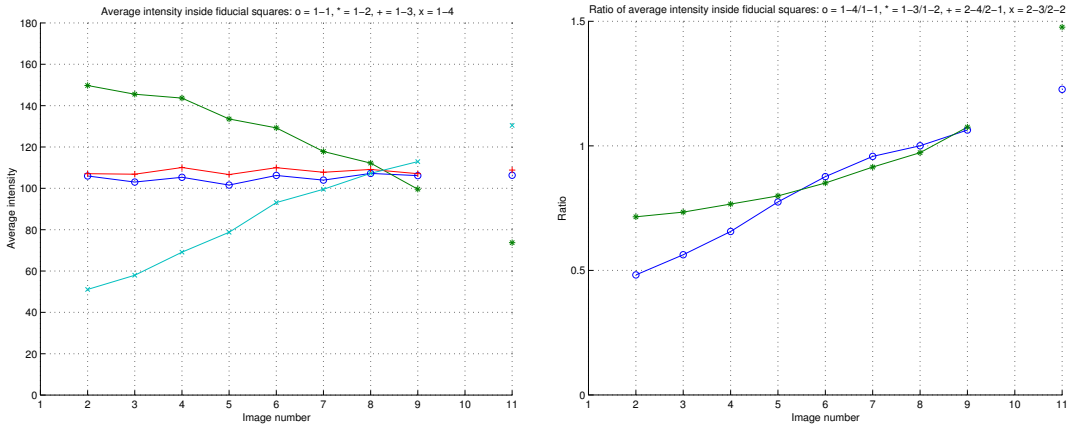
[1] Pajdla Tomáš. Simulating SVAVISCA panoramic images of agam fiducials. Research Report CTU–CMP–2001–01, CAK–340–03–1–2001–01, Center for Machine Perception, K333 FEE, Czech Technical University, Prague, Czech Republic, January 2001.



(a) (b) (c)

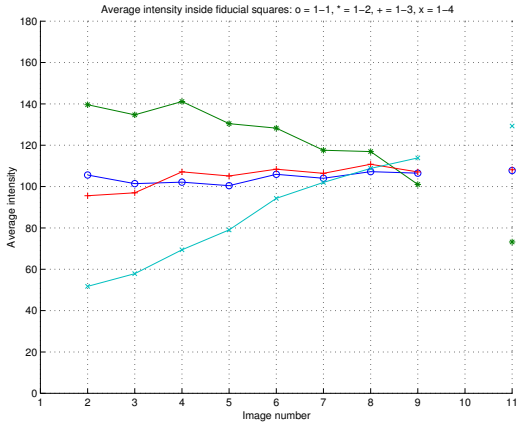


(d)

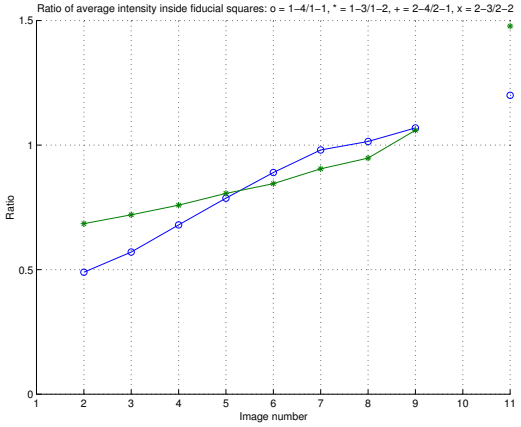


(e)

(f)

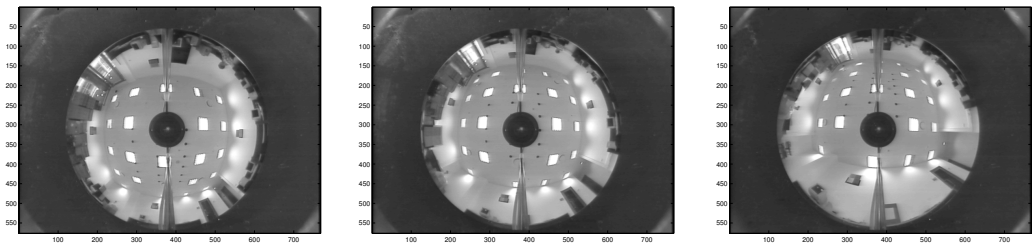


(g)

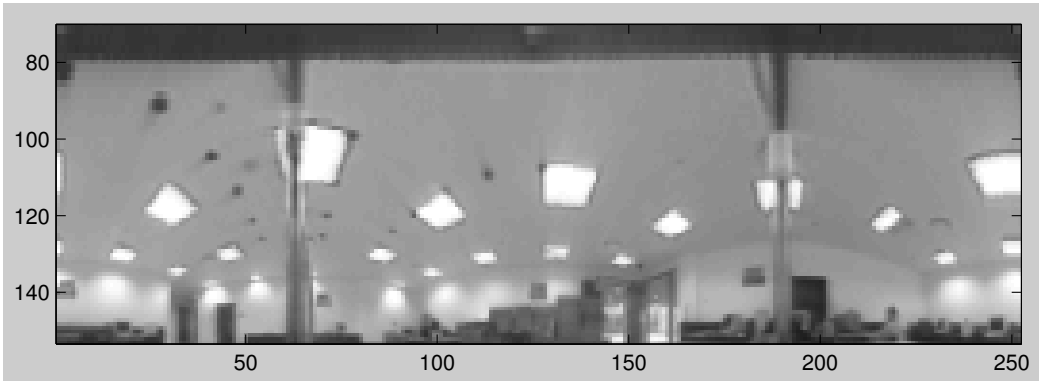


(h)

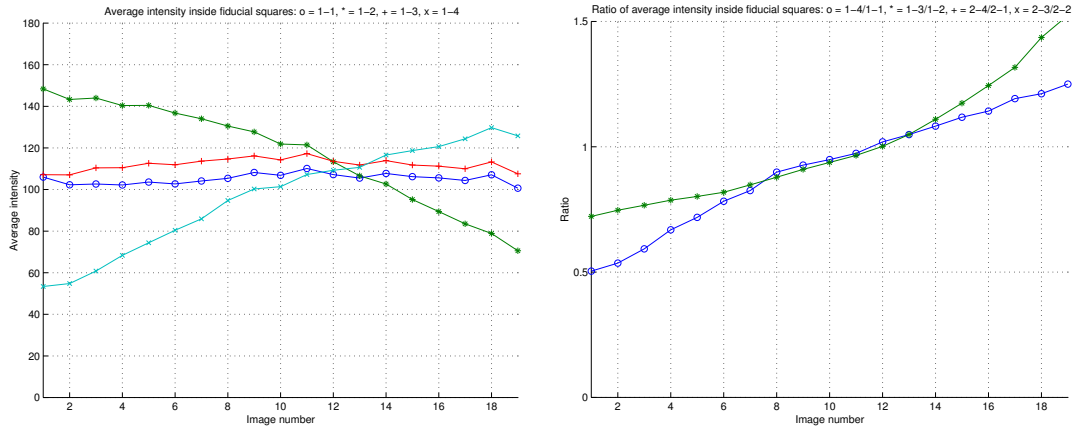
Figure 1: Distance between the fiducial and the observer equals 1 meter. See text for more.



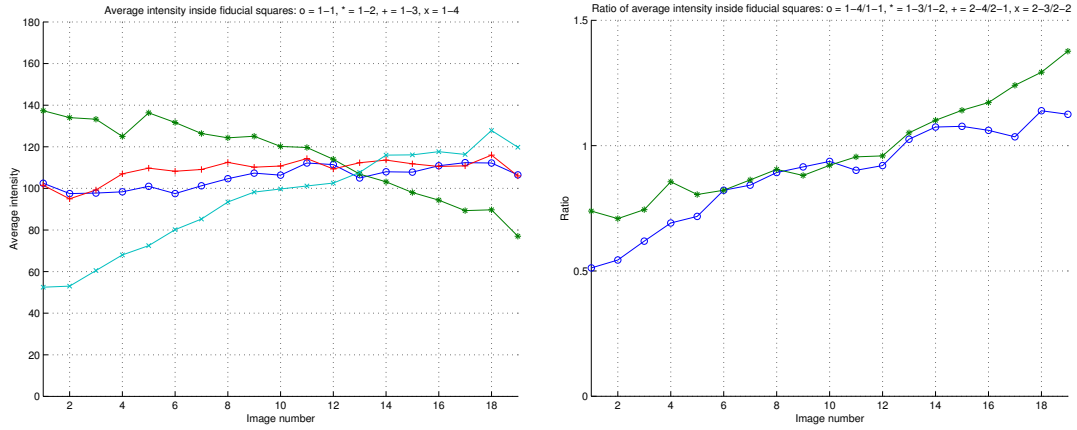
(a) (b) (c)



(d)

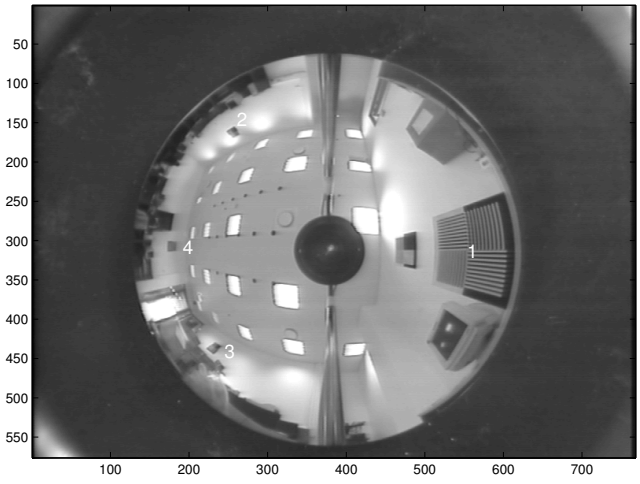


(e) (f)



(g) (h)

Figure 2: Distance between the fiducial and the observer equals 2 meters. See text for more.



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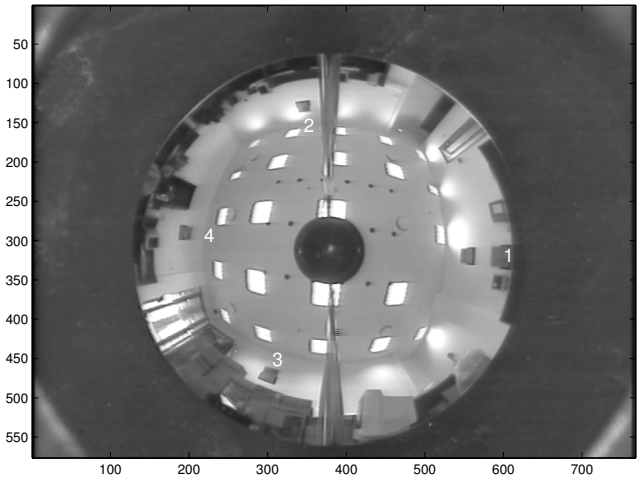
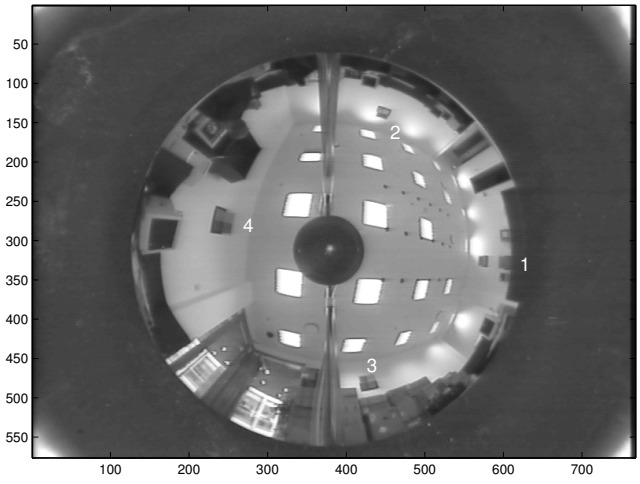


middle



end

Figure 3: Three images from the journey in a room with four fiducials. Fiducials are marked in the images.

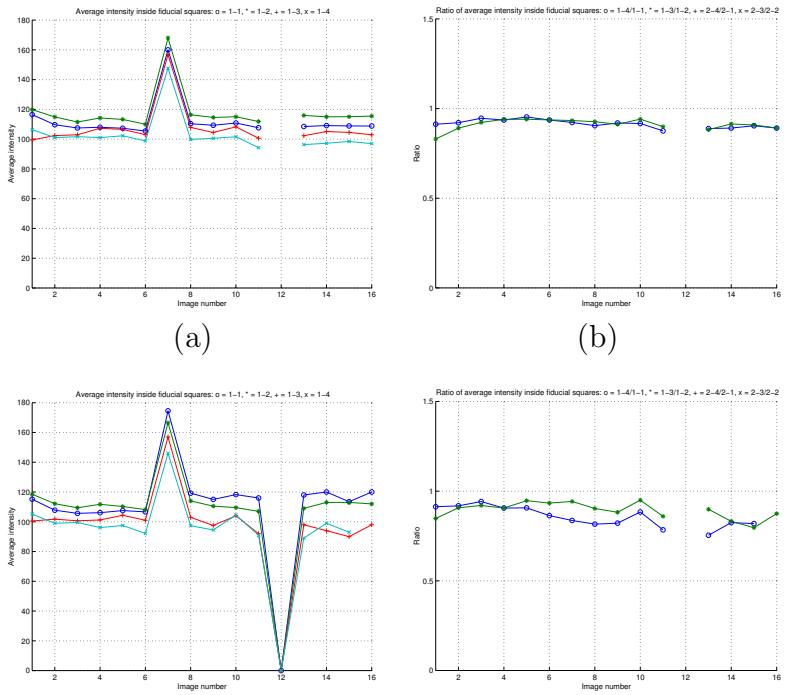


Figure 4: Journey in a room with four fiducials. Average intensities for the fiducial number 1. See text for more.

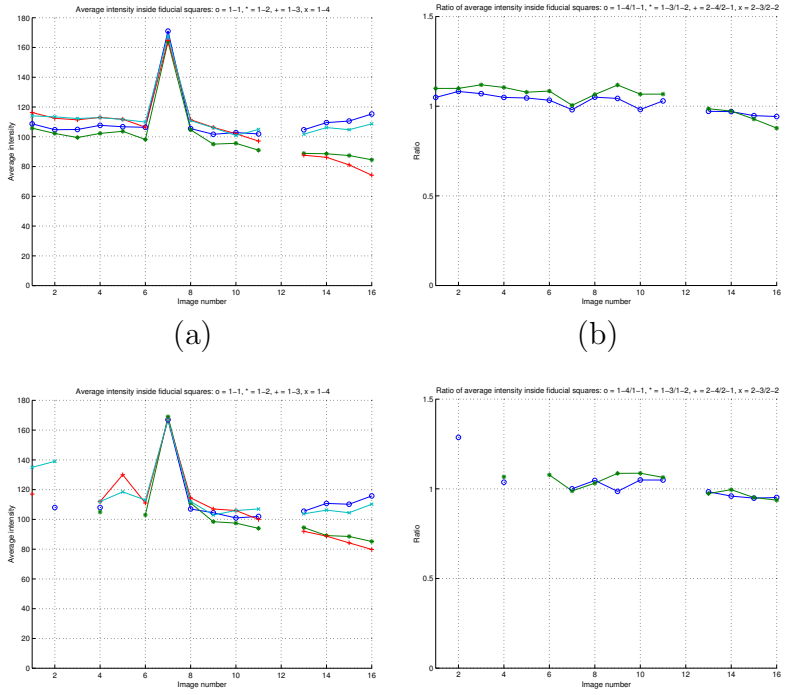


Figure 5: Journey in a room with four fiducials. Average intensities for the fiducial number 2. See text for more.

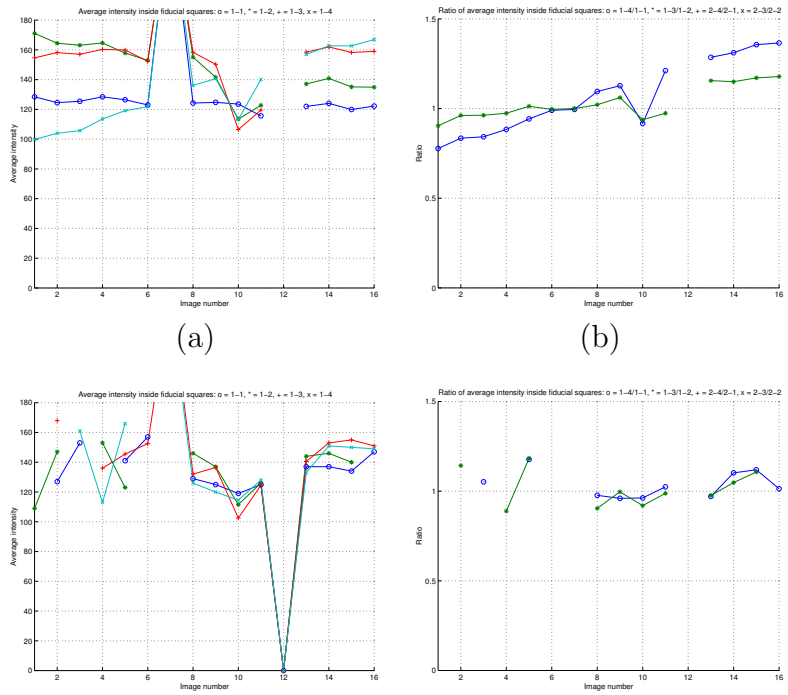


Figure 6: Journey in a room with four fiducials. Average intensities for the fiducial number 3. See text for more.

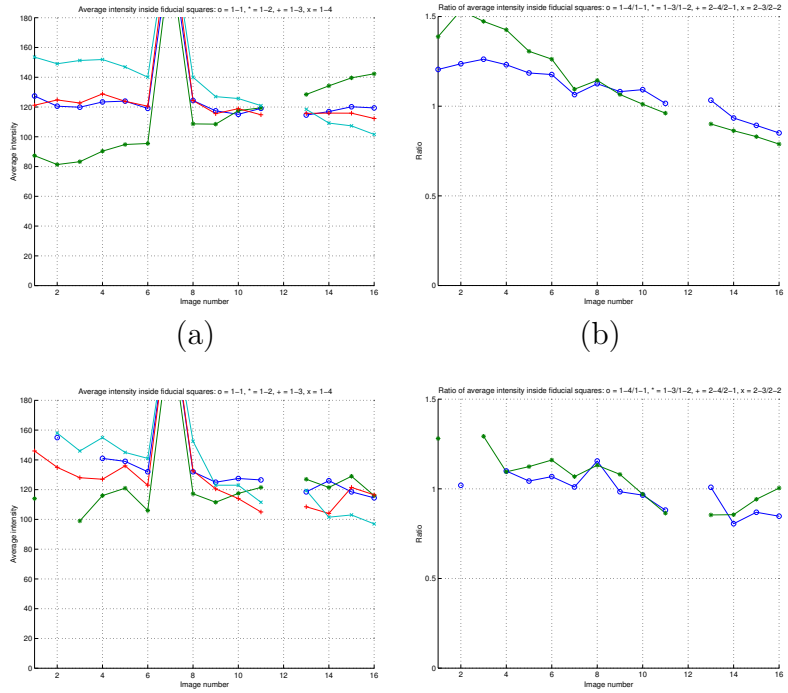


Figure 7: Journey in a room with four fiducials. Average intensities for the fiducial number 4. See text for more.