Continuous room localisation using painting detection

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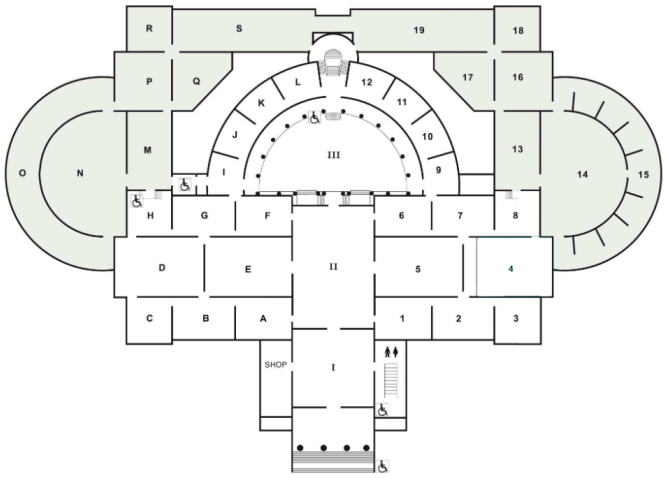

Fig. 1. A ground plan of The Museum of Fine Arts, Ghent.

***Abstract*—This paper describes our method to localise a painting on a ground plan based on The Musem of Fine Arts in Ghent.**

I. Introduction

This paper introduces a framework for rapid painting detection. _ToDo: What makes this work useful?
_ToDo: Why should someone spend time to read this paper

_ToDo: clarification of title and context
_ToDo: which problem has been solved
_ToDo: overview of related work
_ToDo: benefits and shortcomings of related work
_ToDo: overview of your own contributions This paper contains x contributions: _ToDo: overview of results
_ToDo: why these results are useful
_ToDo: overview of structure of the paper In section 2 ...
Based on a frame from a camera which contains a painting, Figure 1 shows the ground plan that is used to mark the correct room

II. Painting Detection

_ToDo: ook dingen uitleggen die niet werkte

- _ToDo: vanishing points
- _ToDo: hough transformatie
- _ToDo: lijn intersectie
- _ToDo: gabor filter
- _ToDo: local binary patterns

_ToDo: gebruik ook afbeeldingen

A. Painting Segmentation

The first step of the algorithm is the segmentation of a painting in an arbitrary video frame. A typical painting contains the art on its own enclosed by a painting frame. This painting frame causes a strong change in environment, increasing the effectiveness of an edge detector. Extracting the edges with the Canny edge detector yields a first indication of where a painting might be. If the full painting frame is visible on the video frame, its contour can be calculated using [1] which returns a vector of points for each contour. We consider only contours which have four points.

It is possible that multiple paintings exist on a single frame,

B. Feature Detection

C. Path Tracking

Once a painting is identified and matched, it can be localised on the ground plan. To achieve this, the ground plan is converted into a directed graph. The nodes of this graph are the rooms of the museum and the edges define the connections between rooms. When a user starts recording paintings, the matching algorithm will be performed on each frame and a location will be found. The graph is able to mark nodes in three distinct ways. A green node is the start of the path, an orange node is an intermediate path and the blue node is the end of the path. The path ends when the user stops recording. The path direction is also visualised by coloring the corresponding edges green. Note that when a cyclic path occurs which was walked in both directions, information of order is lost.

To illustrate the path tracking algorithm, a small segment consisting of rooms 1, 2, 3, 4, 5, 6, 7 and 8 are converted into such a graph and is show on figure 2.

D. Database

The database consists of 688 images of various paintings and sculptures in the museum. In this work we only focus on the paintings of this dataset. The paintings were extracted from two different camera's: a Nokia 7 plus and a Samsung A3. Each image also contains the room in which it resides as metadata.

To reduce the load time of this database, a prebuilding stage was implemented. This stage reduces each image to a collection of interest points and corresponding descriptors for these interest points as generated by the ORB [2] algorithm.

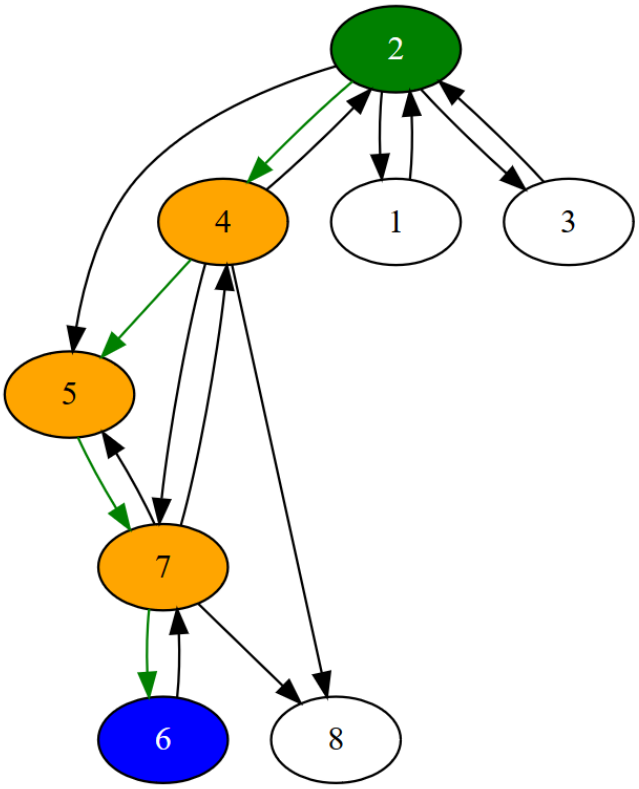

Fig. 2. Path tracking using a graph.

III. Evaluation

To measure the performance metrics of our algorithm, we employ three different methods: for painting segmentation, the matching algorithm and room localisation consistency. First, an evaulation of painting segmentation is done using a random sample of the dataset. In this sample, each painting is segmentated manually, resulting in four coördinates for each image. These coördinates can be compared against the coördinates that are generated by the painting segmentation algorithm. A distance metric is used to compare the closeness of two coördinates.

The matching algorithm has to be evaluated manually by comparing the matcher's result. The correctness of the matching algorithm is simply the ratio of the correct matches against the false matches.

To evaluate the room localisation, a sample of the video dataset was taken. The generated path is compared against the actaul path.

IV. Results

_ToDo: qualitative as well as quantitative
_ToDo: quantitative: graphs, tables, roc-curves, f1-scores, ...

_ToDo: qualititative: technisch, show where and why the method succeeds or fails, pictures of easy and difficulty cases

V. Conclusion

_ToDo: overview of the most important contributions and the results, without introducing anything new
_ToDo: after the reader has read the paper, the reader can look at the contributions and results from a different viewpoint

_ToDo: statements can be made more explicit
_ToDo: eventueel future work

References

[1] S. Suzuki and K. be, "Topological structural analysis of digitized binary images by border following," *Computer Vision, Graphics, and Image Processing*, vol. 30, no. 1, pp. 32 – 46, 1985. [Online]. Available: http://www.sciencedirect.com/science/article/pii/0734189X85900167

[2] E. Rublee, V. Rabaud, K. Konolige, and G. Bradski, "Orb: An efficient alternative to sift or surf," in *2011 International Conference on Computer Vision*, Nov 2011, pp. 2564–2571.