



Bachelor's Thesis

Designing and Implementing a Rephotography Application for iOS

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CONTENTS

1	INTRODUCTION	3
1.1	Overview	3
1.2	Goals of this thesis	3

INTRODUCTION

1.1 OVERVIEW

Rephotography denotes the retrieval of the precise viewpoint used for taking a — possibly historic — photograph and capturing another image from the same spot, ideally with the same camera parameters. This allows for documentation and visualisation of changes which the scene has undergone between the two or more captures. For instance, one can present progress of construction, restoration efforts or changes in the surroundings in a visually striking manner, for instance by blending the photographs together. Figures [Figure 1](#) and [Figure 2](#) show examples.

When done manually, the photographer must attempt to find the original viewpoint usually by visual inspection of the original image and trying to match the current camera parameters — camera position, camera rotation, focal length, possibly principal point — to the original. The procedure is often carried out by placing the camera on a tripod and comparing a printout of the original image with what can be seen through the viewfinder or the camera screen. The number of parameters to match as well as the difficulty to estimate them purely from comparing two-dimensional images makes the process error-prone and tedious. Visual acuity and experience of the photographer thus place limits on the accuracy with which the camera pose of the reference image can be reconstructed.

The advancement of mobile phones or tablet computers with integrated cameras and larger screens presents the opportunity to develop applications which can assist in this endeavour, moving away from the traditional trial-and-error approach. On current digital cameras¹ this is impossible due to their closed infrastructure not permitting running user programs.

1.2 GOALS OF THIS THESIS

¹ At the time of writing, no commercial manufacturer produces a camera with user-modifiable firm- or software. A project at Stanford ([2](#)) was discontinued ([1](#))



Figure 1: Residenzschloss in Dresden, destroyed during World War II, © Sergey Larenkov, printed with permission



Figure 2: Frauenkirche in Dresden, destroyed during World War II, © Sergey Larenkov, printed with permission

2

REF

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- [2] Andrew Adams, Eino-Ville Talvala, Sung Hee Park, David E. Jacobs, Boris Ajdin, Natasha Gelfand, Jennifer Dolson, Daniel Vaquero, Jongmin Baek, Marius Tico, Hendrik P. A. Lensch, Wojciech Matusik, Kari Pulli, Mark Horowitz, and Marc Levoy. The frankencamera: An experimental platform for computational photography. *ACM Trans. Graph.*, 29(4):29:1–29:12, July 2010.