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Flower Reconstruction from a Single Photo

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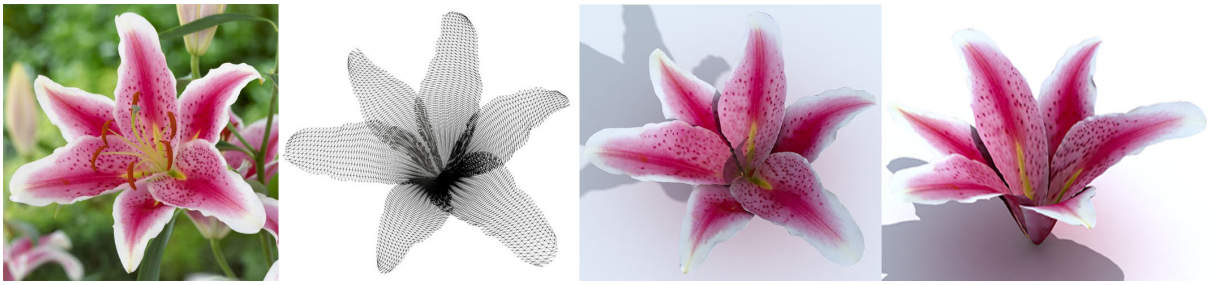

Figure 1: *A lily model is reconstructed from a single photo. From left to right: input photo, reconstructed mesh and textured models from the same view direction as the input, rendering result under a different direction.*

Abstract

We present a semi-automatic method for reconstructing flower models from a single photograph. Such reconstruction is challenging since the 3D structure of a flower can appear ambiguous in projection. However, the flower head typically consists of petals embedded in 3D space that share similar shapes and form certain level of regular structure. Our technique employs these assumptions by first fitting a cone and subsequently a surface of revolution to the flower structure and then computing individual petal shapes from their projection in the photo. Flowers with multiple layers of petals are handled through processing different layers separately. Occlusions are dealt with both within and between petal layers. We show that our method allows users to quickly generate a variety of realistic 3D flowers from photographs and to animate an image using the underlying models reconstructed from our method.

Categories and Subject Descriptors (according to ACM CCS): I.3.5 [Computer Graphics]: Computational Geometry and Object Modeling—; I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism—

1. Introduction

For realistic modeling, many outdoor and indoor scenes have to be decorated with high-quality flower models. Obtaining models for flowers in their natural habitat is non-trivial since flower petals are generally fragile with their shapes easily perturbed during the capture. On the other hand, artists are able to create a model for a flower solely based on a single photo. Nevertheless, this is a tedious task that requires experienced users for good results. Our objective is therefore to present a semi-automatic method for general users, which can reconstruct a flower model from a single photograph with little user interaction.

Despite recent advances in acquisition technology, photograph remains a cheap and easy means to capture reality. However, 3D shape reconstruction from a single image is a highly challenging task. The captured shape is ambiguous mainly due to the lack of depth dimension and occlusion. Methods that reconstruct an object from a single photograph usually require some degree of assistance from the user. Moreover, there are always some priors that help reducing the inherent ambiguities in the observed data [HAA97, HEH05, SCN08, JTC09, CZS*13]. Repetitions also provide significant information that can help alleviate ambiguities. Repeated structural elements, like in common architectural models, observed from different directions, offer multi-view geometry application to a single photograph [WFP11].

We exploit the fact that petals from the single flower usu-