

Ontology Based Semantic Modeling for Chinese Ancient Architectures

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Figure 1: Ancient architectures in southeast China; the top two photos are taken from Hefang Street in Hangzhou, and the other two are taken from Xitang town, Zhejiang Province.

Abstract

Modeling complex architectures is quite challenging. We introduce a novel intelligent system, which can generate semi-style or semi-structure Chinese ancient architectures automatically. By using an ontology based approach to analyze the styles of different architectures, geometry primitives (e.g. point, line, triangle, etc.) are converted into semantic architecture components (e.g. window, gate, roof, etc.) as knowledge. The following modeling process can be performed at different semantic levels, and it is appealing to users having domain knowledge. This intelligent architecture modeling system has been successfully applied in the digital heritage project for ancient architectures in southeast China.

Introduction

Chinese ancient architectures boast a long history and great achievements. As buildings in ancient China are mostly built by wooden material, it is quite difficult to keep them in good

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condition through long history period. In our digital heritage project for ancient architectures in southeast China, the original goal is to build geometrical models of endangered architectures through the help of existing modeling softwares. Two good examples are Hefang Street, Figure 1, which used to be the downtown area of the capital of South Song dynasty from 1217 to 1279, and Xitang, a beautiful riverside town, consists of several blocks of residential houses. Although the scale of the above two examples looks pretty small, modeling individual houses manually for several street blocks is still a big burden. It is not only time demanding but also requires deep domain knowledge regarding a variety of complex house styles involved. It should be very beneficial if the modeling process can be accomplished semi-automatically at semantical level by using accumulated domain knowledge extracted from those architectures directly.

To achieve this goal, we try to apply an ontology-based approach on the architectures modeling process. By this way, an end user can accomplish modeling process in a much more natural way, paying more attention to the semantic relations among different components instead of focusing on geometrical details.

The rest of the sections are organized as follows. Section 2 gives a brief introduction to related works on architectures modeling. Section 3 presents our ontology based solution. In this method, Chinese ancient architectures modeling is considered as an ontology design process. It consists of multi-level projection ontology design and its implementation in practice etc. Section 4 gives implementation details of the modeling system. Experiment results and a short discussion are presented in section 5.

Related Work

Generally speaking, there are two primary categories of modeling technologies, i.e. manual modeling and automated modeling.

In manual modeling, users usually adopt commercial modeling softwares (e.g. AutoCAD, 3D studio max, Maya etc.), to design and render desired heritage buildings. Although manual modeling can generate the most accurate and complicated models, it is very time-consuming. A typical manual modeling case was given by ChiuShui Chan *et al.* (Chan, Tong, & Dang 2003). It is used to build the model of traditional Chinese architectures.

