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Online Social Media Content Delivery

A Data-Driven Approach

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Preface

The delivery of online social video content has become an intriguing research area, along with the increasing popularity of online social networks. Traditional content delivery approaches that are designed without considering social topology and user behaviors are less efficient—if not completely ineffective—for social and socialized content delivery. To address the social video delivery problem, this book studies data-driven solutions, which jointly consider social relationship, user behavior, and content features. It focuses on the characteristics of user preferences in social media, network topology optimization and resource allocation for social content delivery, propagation-based social content replication, and social video service deployment.

1. **Joint Content- and Social-Based User Preference Mining.** The rapid growth of user-generated social videos requires content delivery systems to understand user preferences. To date, user preference inference for social video content has been studied separately: based on either content similarity or user relationships. We investigate a joint social content preference mining framework by using social factors and content factors to jointly learn which content a user will import or re-share in an online social network. In particular, we study a joint matrix completion framework. Experimental results demonstrate that the proposed approach substantially improves the preference mining relative to the baseline approaches.
2. **Enhancing Multimedia Network Resource Allocation Using Social Prediction.** Popularity patterns of social video content have greatly changed: video popularity is highly affected by online social networks, and videos can become 'viral' almost instantaneously. These changes make traditional popularity-based network resource allocation for video services suboptimal. It is intriguing to study a proactive network resource allocation strategy for social video services. Using influential factors summarized from measurement studies, we propose a learning-based framework that uses propagation parameters to predict the number of potential viewers and their geographic distribution. We present proactive strategies that determine the upload capacities of servers in

different regions. We also present experimental results that verify the effectiveness of the proposed algorithms.

3. **Propagation-Based Socially Aware Content Replication.** Online social networks have reshaped the manner in which content is generated, distributed, and consumed on today's Internet. It is intriguing to study service provision of social content for global users with satisfactory quality-of-experience. We conduct large-scale measurements of real-world online social networks to study social propagation and discover important propagation patterns, including social locality, geographical locality, and temporal locality. Motivated by the findings from the measurements, we propose a propagation-based socially aware content delivery framework that uses a hybrid edge-cloud and peer-assisted architecture. Replication strategies are further designed for the architecture based on three propagation predictors designed by jointly considering user, content, and context information. These findings and strategies change the prevalent method of content delivery, which is only based on content popularity, and significantly improve the user experience in receiving social content.
4. **Joint Online Processing and Geo-Distributed Delivery for Dynamic Social Streaming.** Adaptive social streaming has grown rapidly in popularity because it allows heterogeneous users to receive different bitrates. To date, the two important components in dynamic adaptive social streaming—video transcoding, which generates the adaptive bitrates for a video, and video delivery, which streams videos to users—have been separately studied, resulting in a significant waste of computation and storage resources due to transcoding unneeded video data and suboptimal streaming quality due to homogeneous video replication. We investigate the possibility of jointly performing video transcoding and video delivery for adaptive social streaming in an online manner according to the user preferences that are learned from their social behaviors and their preferences of edge servers to receive the video chunks. The proposal significantly improves both the user experience in adaptive social streaming and computational resources utilization of the system.

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Contents

Chapter 1
Introduction

Abstract In this chapter, we provide a review of online video content delivery, presenting the traditional video delivery approaches and the facing challenges. To satisfy the trend for content to be dynamically processed before being delivered to users, we propose a joint online processing and delivery paradigm to improve the user experience in social video services. At the end of this chapter, we give out the structure of the whole book.

Keywords Social media · Social content delivery · Social propagation

1.1 Background

Online social networks have become a popular online service, with an ever increasing number of social network apps, including ones based on "friend" relationships (e.g., Facebook), ones based on "following" relationships (e.g., Twitter), and ones based on professional connections (i.e., LinkedIn). Such applications have successfully changed the manner in which people are connected to each other. In an online social network, users receive a variety of multimedia content, of which online video services are important ones, dominating a large fraction of today's traffic.

Online social networks and online video services are closely connected to each other: users can "import" video content from video sharing sites to online social networks and share the videos with social connections. Such social behaviors have changed how content is delivered to users: using online social networks has become a normal method of accessing videos. Users' actions determine how people select videos to watch, changing the assumption of traditional content delivery systems that users can only *passively* receive content from a content provider.

Traditional video delivery has evolved in the following four stages:

Simple Client/Server (C/S): In this stage, there was little information delivered by the Internet. The number of users and amount of content were both very small. The traditional Client/Server mode uses limited server resources to serve a limited number of users.

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