

概 要

图像的观测颜色被认为是物体前景颜色按照其不透明度信息和背景颜色的叠加。图像抠图就是从观测图像提取出前景颜色和不透明度信息。它在图像特效制作、虚实场景结合、基于图像的建模绘制等领域具有重要的意义。

由于前景和背景信息都是未知的，这一问题从本质上讲是欠约束问题。从自然场景中提取物体对象，成为近年来图形图像领域研究的一个热点，并取得了一些优秀的成果。但由于自然场景的复杂性，这一问题还没有得到很好的解决。

本论文围绕如何从图像中提取颜色的变化规律，根据这些规律进行合理的估计进行了研究，并对视频对象提取中物体边界的自动跟踪进行了研究。主要工作包括：

1. 提出了一种基于结构信息的自然图像抠图算法。通过检测图像的结构信息，得到平滑性约束，选择合理的样本点估计颜色，计算物体的不透明度。本文提出的方法有效地减少了假设约束，能够快速准确地提取物体对象。

2. 提出了一种基于图像梯度差分信息的跟踪方法，能够有效地消除视频跟踪中噪声和光照变化的影响，自动跟踪物体边界，减少了手工交互的工作量。设计实现了视频人物对象精确提取系统，性能比已有的方法有了较大的提高。

关键词：自然图像抠图，对象提取，颜色估计，结构信息，运动对象跟踪。

Research on highly accurate object extraction algorithms based on matting technique

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An image captured by a camera can be considered as a composite of foreground objects and background according to object's opacity value at each pixel. The goal of matting is to extract objects and their opacity information from observed images. This technique plays an important role in image and video post-processing, virtual-real scene combination, object based modeling and rendering.

The matting problem is inherently an under-constrained problem in which foreground and background colors are both unknown. Recently, many efforts have been devoted to developing effective algorithms on natural images and video matting. However, the state-of-the-art of matting is far from perfect due to the great complexity of natural background images.

In this thesis, my research work aims to propose a simple but more efficient matting algorithm based on the following observation: the observed image contains important clues which describe important foreground and background information such as color similarity. Based on the information, we can quickly and efficiently estimate foreground and background information. We also study on the problem of object tracking in video matting. The main contributions of the thesis include:

1. A fast approach for natural image matting based on structure information. We extract the structure information in observed images, and proposed two different color propagation methods to estimate foreground and background colors. Our approach is fast and efficient for natural image matting.

2. A fast moving object tracking method based on gradient difference images. It is robust to noise and illumination changes. It can satisfy the requirement of interactive video object matting systems. Based on the work in this thesis, a new video object extracting system is implemented to extract human body. Experimental results show that the performance of our system is better than other methods.

Keywords: natural image matting, object extraction, color estimation, structure information, moving object tracking.