國立臺灣大學理學院天文物理所
博士論文
Department of Computer Science and Information Engineering
College of Electrical Engineering and Computer Science
National Taiwan University
Doctoral Thesis

新的保守量與原始量的轉換法於狹義相對論性流體力學並使用高速圖形顯示卡於自適性網格

An adaptive mesh, GPU-accelerated, and error minimized special relativistic hydrodynamics code

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中華民國 111 年 6 月
June, 2022

國立臺灣大學博士學位論文
口試委員會審定書

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本論文係曾柏勳君 (D05244001) 在國立臺灣大學天文物理所完成之博士學位論文，於民國 111 年 6 月 28 日承下列考試委員審查通過及口試及格，特此證明

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誌謝

感謝...

Acknowledgements

I'm glad to thank. . .

摘要

本論文提出了一影像中使用者感興趣區域 (region of interest) 偵測之資料集 (benchmark)。使用者感興趣區域偵測在許多應用中極為有用，過去雖然有許多使用者感興趣區域之自動偵測演算法被提出，然而由於缺乏公開資料集，這些方法往往只測試了各自的小量資料而難以互相比較。從其它領域可以發現，基於公開資料集的可重製實驗與該領域突飛猛進密切相關，因此本論文填補了此領域之不足，我們提出名為「Photoshoot」的遊戲來蒐集人們對於感興趣區域的標記，並以這些標記來建立資料集。透過這個遊戲，我們已蒐集大量使用者對於感興趣區域的標記，並結合這些資料成為使用者感興趣區域模型。我們利用這些模型來量化評估五個使用者感興趣區域偵測演算法，此資料集也可更進一步作為基於學習理論演算法的測試資料，因此使基於學習理論的偵測演算法成為可能。

關鍵字： 相對論性流體演算法、費米氣泡、義羅西塔氣泡

Abstract

We present a new special relativistic hydrodynamics (SRHD) code capable of handling coexisting ultra-relativistically hot and non-relativistically cold gases. We achieve this by designing a new algorithm for conversion between primitive and conserved variables in the SRHD solver, which incorporates a realistic ideal-gas equation of state covering both the relativistic and non-relativistic regimes. The code can handle problems involving a Lorentz factor as high as 10^6 and optimally avoid the catastrophic cancellation. In addition, we have integrated this new SRHD solver into the code GAMER (`https://github.com/gamer-project/gamer`) to support adaptive mesh refinement and hybrid OpenMP/MPI/GPU parallelization. It achieves a peak performance of 7×10^7 cell updates per second on a single Tesla P100 GPU and scales well to 2048 GPUs. We apply this code to two interesting astrophysical applications: (a) an asymmetric explosion source on the relativistic blast wave and (b) the flow acceleration and limb-brightening of relativistic jets.

Keywords: relativistic jets, numerical method

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Chapter 1

Introduction

Attention plays an important role in human vision. For example, when we look at an image, our eye movements comprise a succession of *fixations* (repetitive positioning of eyes to parts of the image) and *saccades* (rapid eye jump). Those parts of the image that cause eye fixations and capture primary attention are called *regions of interest* (ROIs). Studies in visual attention and eye movement have shown that humans generally only attend to a few ROIs. Detecting these visually attentive regions in images is challenging but useful in many multimedia applications, such as automatic thumbnail cropping, object recognition, content-based image retrieval, adaptive image compression and automatic browsing in small-screen devices.

Many algorithms have been proposed for automatic ROI detection in images. Unfortunately, these methods were often evaluated only on specific and small data sets that are not publicly available. The lack of published *benchmarks* makes experiments non-repeatable and quantitative evaluation difficult. However, as recommended by the latest ACM SIGMM retreat, repeatable experiments using published benchmarks are important for advancing the multimedia research field [**?**].

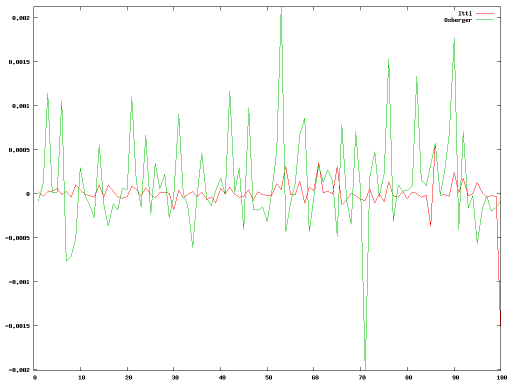

Figure 1.1: kl-distance

	Itti's method	Fuzzy growing
Precision	0.4475	0.4506
Recall	0.5515	0.5542

Table 1.1: Evaluation of FOA sets.