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A Unified Scheme for Image Segmentation and Object Recognition Interactive Co-segmentation of Objects in Image Collections Practical Machine Learning for Computer Vision RGB-DEPTH IMAGE SEGMENTATION AND OBJECT RECOGNITION FOR INDOOR SCENES Object Detection and Segmentation Using Detectron2 Does Image Segmentation Improve Object Categorization? Medical Image Recognition, Segmentation and Parsing How Humans Recognize Objects: Segmentation, Categorization and Individual Identification Moving Object Detection and Segmentation for Remote Aerial Video Surveillance Deep Learning for Computer Vision Hands-On Computer Vision with Detectron2 Hypothesis-based Image Segmentation for Object Learning and Recognition Semantic Video Object Segmentation for Content-Based Multimedia

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Moving Object Detection and Segmentation for Remote Aerial Video Surveillance Aug 19 2022 Deep Learning in Object Recognition, Detection, and Segmentation Mar 14 2022 Deep Learning

in Object Recognition, Detection, and Segmentation provides a comprehensive introductory overview of a topic that is having major impact on many areas of research in signal processing, computer vision, and machine learning.

Medical Image Recognition, Segmentation and Parsing Oct 21 2022 This book describes the technical problems and solutions for automatically recognizing and parsing a medical image into multiple objects, structures, or anatomies. It gives all the key methods, including state-of- the-art approaches based on machine learning, for recognizing or detecting, parsing or segmenting, a cohort of anatomical structures from a medical image. Written by top experts in Medical Imaging, this book is ideal for university researchers and industry practitioners in medical imaging who want a complete reference on key methods, algorithms and applications in medical image recognition, segmentation and parsing of multiple objects. Learn: Research challenges and problems in medical image recognition, segmentation and parsing of multiple objects Methods and theories for medical image recognition, segmentation and parsing of multiple objects Efficient and effective machine

learning solutions based on big datasets Selected applications of medical image parsing using proven algorithms Provides a comprehensive overview of state-of-the-art research on medical image recognition, segmentation, and parsing of multiple objects Presents efficient and effective approaches based on machine learning paradigms to leverage the anatomical context in the medical images, best exemplified by large datasets Includes algorithms for recognizing and parsing of known anatomies for practical applications

Object Detection and Segmentation Using Detectron2 Dec 23 2022 Explore Detectron2 using cutting-edge models and learn all about implementing future computer vision applications in custom domains Purchase of the print or Kindle book includes a free PDF eBook Key Features: Learn how to tackle common computer vision tasks in modern businesses with Detectron2 Leverage Detectron2 performance tuning techniques to control the model's finest details Deploy Detectron2 models into production and develop Detectron2 models for mobile devices Book Description: Computer vision is a crucial component of many modern businesses, including automobiles, robotics, and

manufacturing, and its market is growing rapidly. This book helps you explore Detectron2, Facebook's next-gen library providing cutting-edge detection and segmentation algorithms. It's used in research and practical projects at Facebook to support computer vision tasks, and its models can be exported to TorchScript or ONNX for deployment. The book provides you with step-by-step guidance on using existing models in Detectron2 for computer vision tasks (object detection, instance segmentation, key-point detection, semantic detection, and panoptic segmentation). You'll get to grips with the theories and visualizations of Detectron2's architecture and learn how each module in Detectron2 works. As you advance, you'll build your practical skills by working on two real-life projects (preparing data, training models, fine-tuning models, and deployments) for object detection and instance segmentation tasks using Detectron2. Finally, you'll deploy Detectron2 models into production and develop Detectron2 applications for mobile devices. By the end of this deep learning book, you'll have gained sound theoretical knowledge and useful hands-on skills to help you solve advanced computer vision tasks using Detectron2. What You Will Learn: Build

computer vision applications using existing models in Detectron2 Grasp the concepts underlying Detectron2's architecture and components Develop real-life projects for object detection and object segmentation using Detectron2 Improve model accuracy using Detectron2's performance-tuning techniques Deploy Detectron2 models into server environments with ease Develop and deploy Detectron2 models into browser and mobile environments Who this book is for: If you are a deep learning application developer, researcher, or software developer with some prior knowledge about deep learning, this book is for you to get started and develop deep learning models for computer vision applications. Even if you are an expert in computer vision and curious about the features of Detectron2, or you would like to learn some cutting-edge deep learning design patterns, you will find this book helpful. Some HTML, Android, and C++ programming skills are advantageous if you want to deploy computer vision applications using these platforms.

Graph-based Inference with Constraints for Object Detection and Segmentation Feb 19 2020 For many fundamental problems of computer

vision, adopting a graph-based framework can be straight-forward and very effective. In this thesis, I propose several graph-based inference methods tailored for different computer vision applications. It starts from studying contour-based object detection methods. In particular, We propose a novel framework for contour based object detection, by replacing the hough-voting framework with finding dense subgraph inference. Compared to previous work, we propose a novel shape matching scheme suitable for partial matching of edge fragments. The shape descriptor has the same geometric units as shape context but our shape representation is not histogram based. The key contribution is that we formulate the grouping of partial matching hypotheses to object detection hypotheses is expressed as maximum clique inference on a weighted graph. Consequently, each detection result not only identifies the location of the target object in the image, but also provides a precise location of its contours, since we transform a complete model contour to the image. We achieve very competitive results on ETHZ dataset, obtained in a pure shape-based framework, demonstrate that our method achieves not only accurate object detection but

also precise contour localization on cluttered background. Similar to the task of grouping of partial matches in the contour-based method, in many computer vision problems, we would like to discover certain pattern among a large amount of data. For instance, in the application of unsupervised video object segmentation, where we need automatically identify the primary object and segment the object out in every frame. We propose a novel formulation of selecting object region candidates simultaneously in all frames as finding a maximum weight clique in a weighted region graph. The selected regions are expected to have high objectness score (unary potential) as well as share similar appearance (binary potential). Since both unary and binary potentials are unreliable, we introduce two types of mutex (mutual exclusion) constraints on regions in the same clique: intra-frame and inter-frame constraints. Both types of constraints are expressed in a single quadratic form. An efficient algorithm is applied to compute the maximal weight cliques that satisfy the constraints. We apply our method to challenging benchmark videos and obtain very competitive results that outperform state-of-the-art methods. We also

show that the same maximum weight subgraph with mutex constraints formulation can be used to solve various computer vision problems, such as points matching, solving image jigsaw puzzle, and detecting object using 3D contours.

Object Segmentation in Depth Maps May 24 2020 There are algorithms used for segmenting objects in images, and most of them can provide good quality segmentation results. In this book, we select the most popular segmentation algorithms and apply them to segment depth maps of stereo video sequences for driver assistance. The goal is to segment the potential threatening objects from the background and warn the driver about the potential accident and assist the driver with driving task under the critical situation. People who are interested in the topics of object segmentation, object segmentation in depth maps and driver assistance may want to read this book.

A Comprehensive Review of Modern Object Segmentation Approaches Feb 01 2021 In this monograph, both traditional and modern object segmentation approaches are investigated, comparing their strengths, weaknesses, and utilities. The main focus is on the deep learning-based techniques for the two most widely solved

segmentation tasks: Semantic Segmentation and Instance Segmentation.

Object-Based Image Analysis Mar 22 2020 This book brings together a collection of invited interdisciplinary persp- tives on the recent topic of Object-based Image Analysis (OBIA). Its c- st tent is based on select papers from the 1 OBIA International Conference held in Salzburg in July 2006, and is enriched by several invited chapters. All submissions have passed through a blind peer-review process resulting in what we believe is a timely volume of the highest scientific, theoretical and technical standards. The concept of OBIA first gained widespread interest within the GIScience (Geographic Information Science) community circa 2000, with the advent of the first commercial software for what was then termed 'obje- oriented image analysis'. However, it is widely agreed that OBIA builds on older segmentation, edge-detection and classification concepts that have been used in remote sensing image analysis for several decades. Nevert- less, its emergence has provided a new critical bridge to spatial concepts applied in multiscale landscape analysis, Geographic Information Systems (GIS) and the synergy between image-objects and their

radiometric char- teristics and analyses in Earth Observation data (EO).

How Humans Recognize Objects: Segmentation, Categorization and Individual Identification Sep 20 2022 Human beings experience a world of objects: bounded entities that occupy space and persist through time. Our actions are directed toward objects, and our language describes objects. We categorize objects into kinds that have different typical properties and behaviors. We regard some kinds of objects – each other, for example – as animate agents capable of independent experience and action, while we regard other kinds of objects as inert. We re-identify objects, immediately and without conscious deliberation, after days or even years of non-observation, and often following changes in the features, locations, or contexts of the objects being re-identified. Comparative, developmental and adult observations using a variety of approaches and methods have yielded a detailed understanding of object detection and recognition by the visual system and an advancing understanding of haptic and auditory information processing. Many fundamental questions, however, remain unanswered. What, for example, physically constitutes an "object"?

How do specific, classically-characterizable object boundaries emerge from the physical dynamics described by quantum theory, and can this emergence process be described independently of any assumptions regarding the perceptual capabilities of observers? How are visual motion and feature information combined to create object information? How are the object trajectories that indicate persistence to human observers implemented, and how are these trajectory representations bound to feature representations? How, for example, are point-light walkers recognized as single objects? How are conflicts between trajectory-driven and feature-driven identifications of objects resolved, for example in multiple-object tracking situations? Are there separate "what" and "where" processing streams for haptic and auditory perception? Are there haptic and/or auditory equivalents of the visual object file? Are there equivalents of the visual object token? How are object-identification conflicts between different perceptual systems resolved? Is the common assumption that "persistent object" is a fundamental innate category justified? How does the ability to identify and categorize objects relate to the ability to name and describe them

using language? How are features that an individual object had in the past but does not have currently represented? How are categorical constraints on how objects move or act represented, and how do such constraints influence categorization and the re-identification of individuals? How do human beings re-identify objects, including each other, as persistent individuals across changes in location, context and features, even after gaps in observation lasting months or years? How do human capabilities for object categorization and re-identification over time relate to those of other species, and how do human infants develop these capabilities? What can modeling approaches such as cognitive robotics tell us about the answers to these questions? Primary research reports, reviews, and hypothesis and theory papers addressing questions relevant to the understanding of perceptual object segmentation, categorization and individual identification at any scale and from any experimental or modeling perspective are solicited for this Research Topic. Papers that review particular sets of issues from multiple disciplinary perspectives or that advance integrative hypotheses or models that take data

from multiple experimental approaches into account are especially encouraged.

RGB-DEPTH IMAGE SEGMENTATION AND OBJECT RECOGNITION FOR INDOOR SCENES Jan 24 2023 With the advent of Microsoft Kinect, the landscape of various vision-related tasks has been changed. Firstly, using an active infrared structured light sensor, the Kinect can provide directly the depth information that is hard to infer from traditional RGB images. Secondly, RGB and depth information are generated synchronously and can be easily aligned, which makes their direct integration possible. In this thesis, I propose several algorithms or systems that focus on how to integrate depth information with traditional visual appearances for addressing different computer vision applications. Those applications cover both low level (image segmentation, class agnostic object proposals) and high level (object detection, semantic segmentation) computer vision tasks. To firstly understand whether and how depth information is helpful for improving computer vision performances, I start research on the image segmentation field, which is a fundamental problem and has been studied extensively in natural color images. We propose

an unsupervised segmentation algorithm that is carefully crafted to balance the contribution of color and depth features in RGB-D images. The segmentation problem is then formulated as solving the Maximum Weight Independence Set (MWIS) problem. Given superpixels obtained from different layers of a hierarchical segmentation, the saliency of each superpixel is estimated based on balanced combination of features originating from depth, gray level intensity, and texture information. We evaluate the segmentation quality based on five standard measures on the commonly used NYU-v2 RGB-Depth dataset. A surprising message indicated from experiments is that unsupervised image segmentation of RGB-D images yields comparable results to supervised segmentation. In image segmentation, an image is partitioned into several groups of pixels (or super-pixels). We take one step further to investigate on the problem of assigning class labels to every pixel, i.e., semantic scene segmentation. We propose a novel image region labeling method which augments CRF formulation with hard mutual exclusion (mutex) constraints. This way our approach can make use of rich and accurate 3D geometric structure coming from Kinect in a

principled manner. The final labeling result must satisfy all mutex constraints, which allows us to eliminate configurations that violate common sense physics laws like placing a floor above a night stand. Three classes of mutex constraints are proposed: global object co-occurrence constraint, relative height relationship constraint, and local support relationship constraint. Segments obtained from image segmentation can be either too fine or too coarse. A full object region not only conveys global features but also arguably enriches contextual features as confusing background is separated. We propose a novel unsupervised framework for automatically generating bottom up class independent object candidates for detection and recognition in cluttered indoor environments. Utilizing raw depth map, we propose a novel plane segmentation algorithm for dividing an indoor scene into predominant planar regions and non-planar regions. Based on this partition, we are able to effectively predict object locations and their spatial extensions. Our approach automatically generates object proposals considering five different aspects: Non-planar Regions (NPR), Planar Regions (PR), Detected Planes (DP), Merged Detected Planes

(MDP) and Hierarchical Clustering (HC) of 3D point clouds. Object region proposals include both bounding boxes and instance segments. Although 2D computer vision tasks can roughly identify where objects are placed on image planes, their true locations and poses in the physical 3D world are difficult to determine due to multiple factors such as occlusions and the uncertainty arising from perspective projections. However, it is very natural for human beings to understand how far objects are from viewers, object poses and their full extents from still images. These kind of features are extremely desirable for many applications such as robotics navigation, grasp estimation, and Augmented Reality (AR) etc. In order to fill the gap, we addresses the problem of amodal perception of 3D object detection. The task is to not only find object localizations in the 3D world, but also estimate their physical sizes and poses, even if only parts of them are visible in the RGB-D image. Recent approaches have attempted to harness point cloud from depth channel to exploit 3D features directly in the 3D space and demonstrated the superiority over traditional 2D representation approaches. We revisit the amodal 3D detection problem by sticking to the

2D representation framework, and directly relate 2D visual appearance to 3D objects. We propose a novel 3D object detection system that simultaneously predicts objects' 3D locations, physical sizes, and orientations in indoor scenes.

Deep Learning for Computer Vision Jul 18 2022 Learn how to model and train advanced neural networks to implement a variety of Computer Vision tasks Key Features Train different kinds of deep learning model from scratch to solve specific problems in Computer Vision Combine the power of Python, Keras, and TensorFlow to build deep learning models for object detection, image classification, similarity learning, image captioning, and more Includes tips on optimizing and improving the performance of your models under various constraints Book Description Deep learning has shown its power in several application areas of Artificial Intelligence, especially in Computer Vision. Computer Vision is the science of understanding and manipulating images, and finds enormous applications in the areas of robotics, automation, and so on. This book will also show you, with practical examples, how to develop Computer Vision applications by leveraging the power of deep learning. In this book, you will learn different techniques related

to object classification, object detection, image segmentation, captioning, image generation, face analysis, and more. You will also explore their applications using popular Python libraries such as TensorFlow and Keras. This book will help you master state-of-the-art, deep learning algorithms and their implementation. What you will learn Set up an environment for deep learning with Python, TensorFlow, and Keras Define and train a model for image and video classification Use features from a pre-trained Convolutional Neural Network model for image retrieval Understand and implement object detection using the real-world Pedestrian Detection scenario Learn about various problems in image captioning and how to overcome them by training images and text together Implement similarity matching and train a model for face recognition Understand the concept of generative models and use them for image generation Deploy your deep learning models and optimize them for high performance Who this book is for This book is targeted at data scientists and Computer Vision practitioners who wish to apply the concepts of Deep Learning to overcome any problem related to Computer Vision. A basic knowledge of programming in Python—and some understanding of machine

learning concepts—is required to get the best out of this book.

Practical Machine Learning for Computer Vision Feb 25 2023 This practical book shows you how to employ machine learning models to extract information from images. ML engineers and data scientists will learn how to solve a variety of image problems including classification, object detection, autoencoders, image generation, counting, and captioning with proven ML techniques. This book provides a great introduction to end-to-end deep learning: dataset creation, data preprocessing, model design, model training, evaluation, deployment, and interpretability. Google engineers Valliappa Lakshmanan, Martin Görner, and Ryan Gillard show you how to develop accurate and explainable computer vision ML models and put them into large-scale production using robust ML architecture in a flexible and maintainable way. You'll learn how to design, train, evaluate, and predict with models written in TensorFlow or Keras. You'll learn how to: Design ML architecture for computer vision tasks Select a model (such as ResNet, SqueezeNet, or EfficientNet) appropriate to your task Create an end-to-end ML pipeline to train, evaluate, deploy,

and explain your model Preprocess images for data augmentation and to support learnability Incorporate explainability and responsible AI best practices Deploy image models as web services or on edge devices Monitor and manage ML models

An Image Segmentation and Object Oriented Classification Approach to a High Spatial Resolution Image Nov 29 2020

Object Segmentation and Tracking in Videos Oct 09 2021 Object detection and segmentation are some of the key components of Computer Vision, which have wide ranging real world applications. The current state of the art techniques in computer vision are based on Deep Neural Networks and one of the key challenges is using the state of the art techniques in these fields on novel images, and videos in different environments, and classes. These methods require expensive manual annotations and transfer learning to make them work on domains different from their training data sets. In this thesis, we explore both domain adaptation, and deep learning techniques that don't necessarily rely on the idea of a class, to help with the annotation of private videos. We implemented the initial idea of domain adaptation for directly

annotating objects and followed with using video object segmentation (VOS) tracking methods for propagating annotations. Their application to a novel video acquired in the GURU lab is explored as well as ways to improve their performance.

Data-driven Object Segmentation in Single Images with Random Field Models Sep 27 2020 As humans, we have a remarkable ability of telling objects apart from cluttered background and tracing their contours even with occlusions. This ability has long fascinated computer vision researchers to study the principles and algorithms for object segmentation. Object segmentation has both theoretical and practical interests as it is an essential step towards 3D image understanding and intelligent image editing. To segment an object, we have to recognize it in order to obtain knowledge of what parts should be grouped together. In this thesis, we formulate object segmentation as an image labeling problem in random field models to facilitate integrating top-down recognition knowledge with bottom-up image cues. The integration can be driven by either bottom-up segmentation or top-down recognition. The segmentation-driven process requires object-level segmentation hypotheses drawn from

bottom-up cues while the recognition-driven process needs shape and context to be effectively represented. This thesis addresses these issues in a data-driven approach. First, we propose to generate object segmentation proposals from segmentation trees using exemplars. Compared to previous parametric methods, our data-driven method takes advantage of both diversity and informativeness of exemplars and thus produce a compact set of highly plausible proposals. Second, we propose novel random field models that enjoy joint learning of shape representation and object segmentation. Different from previous works that use shape representation as prior, our model emphasizes the structured prediction from the recognition model to the shape model. This difference ensures the the shape is well preserved in the resulting segmentation masks with robustness to partial occlusions. Third, we develop a novel nonparametric method based on multiscale shape transfer, which in turns forms a higher-order random field. Compared to previous works that transfer rigid or deformable masks in image subwindows, our method explores shape masks in multiple granularities and is able to produce high quality segmentations in an efficient way. The last but not least, we develop a

novel scene parsing system where small objects are segmented in context. With extensive use of context in multiscale and particular care to the long-tailed label distribution, our system demonstrates state-of-the-art results in large-scale problems.

Simultaneous Object Detection and Segmentation Using Top-down and Bottom-up Processing Jun 24 2020 Abstract: This thesis addresses the fundamental tasks of detecting objects in images, recovering their location, and determining their silhouette shape. We focus on object detection techniques that 1) enable simultaneous recovery of object location and object shape, 2) require minimal manual supervision during training, and 3) are capable of consistent performance under varying imaging conditions found in real-world scenarios. The work described here results in the development of a unified method for simultaneously acquiring both the location and the silhouette shape of specific object categories in outdoor scenes. The proposed algorithm integrates top-down and bottom-up processing, and combines cues from these processes in a balanced manner. The framework provides the capability to incorporate both appearance and motion information, making

use of low-level contour-based features, mid-level perceptual cues, and higher-level statistical analysis. A novel Markov random field formulation is presented that effectively integrate the various cues from the top-down and bottom-up processes. The algorithm attempts to leverage the natural structure of the world, thereby requiring minimal user supervision during training. Extensive experimental evaluation shows that the approach is applicable to different object categories, and is robust to challenging conditions such as large occlusions and drastic changes in viewpoint. For static camera scenarios, we present a contour-based background-subtraction technique. Utilizing both intensity and gradient information, the algorithm constructs a fuzzy representation of foreground boundaries called a Contour Saliency Map. Combined with a low-level data-driven approach for contour completion and closure, the approach is able to accurately recover object shape. We also present object detection and segmentation approaches that combine information from visible and thermal imagery. For object detection, we present a contour-based fusion algorithm for background-subtraction. We also introduce a feature-selection approach for object

segmentation from multiple imaging modalities. Starting from an incomplete segmentation from one sensor, the approach automatically extracts relevant information from other sensors to generate a complete segmentation of the object. The algorithm utilizes criteria based on Mutual Information for defining feature relevance, and does not rely on a training phase.

Semantic Video Object Segmentation for Content-Based Multimedia Applications Apr 15 2022 Semantic Video Object Segmentation for Content-Based Multimedia Applications provides a thorough review of state-of-the-art techniques as well as describing several novel ideas and algorithms for semantic object extraction from image sequences. Semantic object extraction is an essential element in content-based multimedia services, such as the newly developed MPEG4 and MPEG7 standards. An interactive system called SIVOG (Smart Interactive Video Object Generation) is presented, which converts user's semantic input into a form that can be conveniently integrated with low-level video processing. Thus, high-level semantic information and low-level video features are integrated seamlessly into a smart segmentation system. A region and temporal

adaptive algorithm was further proposed to improve the efficiency of the SIVOG system so that it is feasible to achieve nearly real-time video object segmentation with robust and accurate performances. Also included is an examination of the shape coding problem and the object segmentation problem simultaneously. Semantic Video Object Segmentation for Content-Based Multimedia Applications will be of great interest to research scientists and graduate-level students working in the area of content-based multimedia representation and applications and its related fields.

A Unified Scheme for Image Segmentation and Object Recognition Apr 27 2023 In this thesis, we present a unified scheme for image segmentation and object recognition. The scheme unifies image segmentation and object recognition via three serial stages: (1) optimal edge detection and region detection; (2) scale, position and orientation invariant object detection; and (3) high-level knowledge-based image segmentation. In the first stage, edges are detected using a new edge detection algorithm and regions are extracted using a morphological-watershed-like segmentation algorithm. The new edge detection algorithm detects edges in an

image with a curve-segment-based edge detection functional, which uses the Laplacian of Gaussian (LOG) zero-crossing contours as initial conditions to approach the true edge locations. The edge detection functional is shown to be optimal in terms of signal-to-noise ratio and edge localization accuracy for detecting general 2D edges. In addition, the resulting edge candidates preserve the nice scaling behavior of the LOG zero-crossing contours in scale space. Based on the edge and region detection results from the first stage, the second stage detects objects of interest, e.g., human faces, using a new object detection algorithm. The new algorithm combines template matching methods with feature-based methods via hierarchical Markov random fields (MRFs) and maximum a posteriori probability (MAP) estimation. Hierarchical MRFs and MAP estimation provide a flexible framework to incorporate various visual clues. The combination of template matching and feature detection is shown to provide robustness for object detection against pose changes, complex background, and partial occlusions. Finally based on the object detection results from the second stage, the third stage extracts the features of the detected targets, e.g., the eyes and the mouths

of the detected faces, using a new deformable template matching algorithm. To reduce the probability of getting stuck in local minima, the new algorithm employs a coarse-to-fine scale space technique and uses the normalized cross-correlation to provide initial conditions for its deformation process. It also uses the optimal edge detection functional developed in this thesis to achieve the best accuracy for localizing the feature boundaries. Experimental results on real images from all the three stages are given in the thesis.

A Heuristic Region Based Image Segmentation Technique for Object Detection Dec 19 2019

Image Segmentation and Shape Matching for Object Recognition Jul 06 2021

Image Segmentation and Contextual Modeling for Object Recognition Feb 13 2022 Recognizing objects is an essential part of navigating through the visual world. Identifying objects and finding boundaries between them provides us with some of the richest sensory information. Similarly, image segmentation and object recognition are among the most fundamental problems in computer vision and machine intelligence. The potential interaction between these processes has been discussed for many years. The

usefulness of recognition for segmentation was demonstrated with various top-down segmentation algorithms; however, the impact of bottom-up image segmentation for object recognition is not well understood. One impeding factor is the unsatisfactory quality of image segmentation algorithms. In this work, we take advantage of a recently proposed method for computing multiple stable segmentations and illustrate the application of bottom-up image segmentation as a preprocessing step for object recognition. In parallel to segmentation, the task of visual object recognition is often greatly facilitated by the objects' surroundings. Contextual information can play the very important role of reducing ambiguity in objects' visual appearance. In this dissertation, we propose a new model for object recognition that incorporates two types of context -- co-occurrence and relative location -- with local appearance-based features, thus named CoLA (for Co-occurrence, Location and Appearance). Since a number of contextual models for recognition have been proposed in the recent history, it is necessary to compare the newly proposed model to the existing ones. Over the years, two general kinds of such models have

emerged: those with contextual inference based on the statistical summary of the scene, and models representing the context in terms of relationships among objects in the image. Understanding the theoretical and practical properties of such approaches is essential in designing object recognition systems. We provide an analytical analysis of these models and evaluate them empirically.

Segmentation Features, Visibility Modeling and Shared Parts for Object Detection Apr 22 2020

Scene Segmentation and Object Classification for Place Recognition Jan 12 2022 This dissertation addresses the place recognition and loop detection problem in large scale outdoor environments. It is noticeable that humans are capable of recognizing places with ease even in large complex environments. Many psychological works support that humans perceive a scene based on the perception of objects. Instead of creating a detailed representation of all the objects in a scene, human visual systems build an economic scene representation by putting emphasis on the extraction of a few key 'aspects' of the scene information, such as an inventory of salient objects and the layout of these objects, etc. This economic representation results in an

enormous saving of processing and memory resources, which plays a key role for the success of human visual system on place recognition. This dissertation tries to solve the place recognition and loop closing problem in a way similar to human visual system. First, a novel image segmentation algorithm is developed. The image segmentation algorithm is based on a Perceptual Organization model, which allows the image segmentation algorithm to 'perceive' the special structural relations among the constituent parts of an unknown object and hence to group them together without object-specific knowledge. Then a new object recognition method is developed. Based on the fairly accurate segmentations generated by the image segmentation algorithm, an informative object description that includes not only the appearance (colors and textures), but also the parts layout and shape information is built. Then a novel feature selection algorithm is developed. The feature selection method can select a subset of features that best describes the characteristics of an object class. Classifiers trained with the selected features can classify objects with high accuracy. In next step, a subset of the salient objects in a scene is selected as

landmark objects to label the place. The landmark objects are highly distinctive and widely visible. Each landmark object is represented by a list of SIFT descriptors extracted from the object surface. This object representation allows us to reliably recognize an object under certain viewpoint changes. To achieve efficient scene-matching, an indexing structure is developed. Both texture feature and color feature of objects are used as indexing features. The texture feature and the color feature are viewpoint-invariant and hence can be used to effectively find the candidate objects with similar surface characteristics to a query object. Experimental results show that the object-based place recognition and loop detection method can efficiently recognize a place in a large complex outdoor environment.

Unsupervised Offline Video Object Segmentation Using Object Enhancement and Region Merging Jan 20 2020

Improving Object Detection and Segmentation by Utilizing Context Dec 31 2020 Object detection and segmentation are important computer vision problems that have applications in several domains such as autonomous driving, virtual and augmented reality systems, human-

computer interaction etc. In this dissertation, we study how to improve object detection and segmentation by utilizing different contexts. Context refers to one of many application scenarios such as (i) video frames for consistent prediction over time, (ii) specific domain knowledge such as human keypoints for person segmentation, and (iii) implementation context aiming for efficiency in embedded systems. Temporal Context of Videos: Video data understanding has drawn considerable interest in recent times as a result of access to huge amount of video data and success in image-based models for visual tasks. However, motion blur, compression artifacts cause apparently consistent video signals to produce high temporal variation on frame-level output for vision tasks such as object detection or semantic segmentation. We study and propose efficient early, and high-level visual processing algorithms by leveraging video content in a streaming fashion. We show how to fuse motion and color to achieve improved streaming hierarchical supervoxels. As a high-level visual task, we propose consistent and efficient video object detection using Convolutional Neural Network (CNN) by clustering video object

proposals and propagating object class labels through the videos. Next, we propose an end-to-end framework for learning video object detection through Recurrent Neural Network (RNN) by posing video as a time series. We also present a post-processing framework for improving semantic segmentation in videos. Domain Knowledge Context for Segmentation: Person instance segmentation is a promising research frontier for a range of applications such as human-robot interaction, sports performance analysis, and action recognition. Human keypoints are a well-studied representation of people. We explore how to use keypoint models to improve instance-level person segmentation in constrained and unconstrained environments with or without training. Efficiency Context for Embedded Implementation: To make an object detector system amenable for embedded implementation, we propose a low-complexity fully convolutional neural network. Additionally, we employ 8-bit quantization on the learned weights. As a mobile use case, we choose face detection. The results show that the proposed method achieves comparative accuracy comparing with the state-of-the-art CNN-based object detection methods while reducing the

model size by 3x and memory-BW by 3-4x comparing with its strongest baseline.

Image Segmentation Evaluation and Its Application to Object Detection Mar 02 2021 The first parts of this Thesis are focused on the study of the supervised evaluation of image segmentation algorithms. Supervised in the sense that the segmentation results are compared to a human-made annotation, known as ground truth, by means of different measures of similarity. The evaluation depends, therefore, on three main points. First, the image segmentation techniques we evaluate. We review the state of the art in image segmentation, making an explicit difference between those techniques that provide a flat output, that is, a single clustering of the set of pixels into regions; and those that produce a hierarchical segmentation, that is, a tree-like structure that represents regions at different scales from the details to the whole image. Second, ground-truth databases are of paramount importance in the evaluation. They can be divided into those annotated only at object level, that is, with marked sets of pixels that refer to objects that do not cover the whole image; or those with annotated full partitions, which provide a full

clustering of all pixels in an image. Depending on the type of database, we say that the analysis is done from an object perspective or from a partition perspective. Finally, the similarity measures used to compare the generated results to the ground truth are what will provide us with a quantitative tool to evaluate whether our results are good, and in which way they can be improved. The main contributions of the first parts of the thesis are in the field of the similarity measures. First of all, from an object perspective, we review the used basic measures to compare two object representations and show that some of them are equivalent. In order to evaluate full partitions and hierarchies against an object, one needs to select which of their regions form the object to be assessed. We review and improve these techniques by means of a mathematical model of the problem. This analysis allows us to show that hierarchies can represent objects much better with much less number of regions than flat partitions. From a partition perspective, the literature about evaluation measures is large and entangled. Our first contribution is to review, structure, and deduplicate the measures available. We provide a new measure that we show that improves

previous ones in terms of a set of qualitative and quantitative meta-measures. We also extend the measures on flat partitions to cover hierarchical segmentations. The second part of this Thesis moves from the evaluation of image segmentation to its application to object detection. In particular, we build on some of the conclusions extracted in the first part to generate segmented object candidates. Given a set of hierarchies, we build the pairs and triplets of regions, we learn to combine the set from each hierarchy, and we rank them using low-level and mid-level cues. We conduct an extensive experimental validation that show that our method outperforms the state of the art in many metrics tested.

How Humans Recognize Objects: Segmentation, Categorization and Individual Identification May 04 2021 Human beings experience a world of objects: bounded entities that occupy space and persist through time. Our actions are directed toward objects, and our language describes objects. We categorize objects into kinds that have different typical properties and behaviors. We regard some kinds of objects - each other, for example - as animate agents capable of independent experience and action, while we

regard other kinds of objects as inert. We re-identify objects, immediately and without conscious deliberation, after days or even years of non-observation, and often following changes in the features, locations, or contexts of the objects being re-identified. Comparative, developmental and adult observations using a variety of approaches and methods have yielded a detailed understanding of object detection and recognition by the visual system and an advancing understanding of haptic and auditory information processing. Many fundamental questions, however, remain unanswered. What, for example, physically constitutes an "object"? How do specific, classically-characterizable object boundaries emerge from the physical dynamics described by quantum theory, and can this emergence process be described independently of any assumptions regarding the perceptual capabilities of observers? How are visual motion and feature information combined to create object information? How are the object trajectories that indicate persistence to human observers implemented, and how are these trajectory representations bound to feature representations? How, for example, are point-light walkers recognized as single objects? How

are conflicts between trajectory-driven and feature-driven identifications of objects resolved, for example in multiple-object tracking situations? Are there separate "what" and "where" processing streams for haptic and auditory perception? Are there haptic and/or auditory equivalents of the visual object file? Are there equivalents of the visual object token? How are object-identification conflicts between different perceptual systems resolved? Is the common assumption that "persistent object" is a fundamental innate category justified? How does the ability to identify and categorize objects relate to the ability to name and describe them using language? How are features that an individual object had in the past but does not have currently represented? How are categorical constraints on how objects move or act represented, and how do such constraints influence categorization and the re-identification of individuals? How do human beings re-identify objects, including each other, as persistent individuals across changes in location, context and features, even after gaps in observation lasting months or years? How do human capabilities for object categorization and re-identification over time relate to those of other

species, and how do human infants develop these capabilities? What can modeling approaches such as cognitive robotics tell us about the answers to these questions? Primary research reports, reviews, and hypothesis and theory papers addressing questions relevant to the understanding of perceptual object segmentation, categorization and individual identification at any scale and from any experimental or modeling perspective are solicited for this Research Topic. Papers that review particular sets of issues from multiple disciplinary perspectives or that advance integrative hypotheses or models that take data from multiple experimental approaches into account are especially encouraged.

Does Image Segmentation Improve Object Categorization? Nov 22 2022 Image segmentation and object recognition are among the most fundamental problems in computer vision, and the potential interaction between these tasks has been discussed for many years. The usefulness of recognition for segmentation has been demonstrated with various top-down segmentation algorithms, however, the impact of bottom-up image segmentation as pre-processing for object recognition is not well understood.

One factor impeding the utility of segmentation for recognition is the unsatisfactory quality of image segmentation algorithms. In this work we take advantage of a recently proposed method for computing multiple stable segmentations and illustrate the application of bottom-up image segmentation as a preprocessing step for object recognition and categorization. We extend a popular bag-of-features recognition model to provide multiple class categorization and localization of objects in images. We compare our categorization results to that of a conventional bag-of-features recognition model on the Caltech and PASCAL image databases.

From Fragments to Objects Nov 10 2021 "This book addresses the problem of how the human visual system organizes inputs that are fragmented in space and time into coherent, stable perceptual units - objects. In doing so it addresses the following questions: what kinds of segmentation and grouping abilities exist in human perceivers? What information and computational processes achieve segmentation and grouping? What are the psychological consequences of perceiving whole objects?" "From Fragments to Objects: Segmentation and Grouping in Vision takes a comprehensive

cognitive science approach to object perception, brings together separate lines of research in object perception in one volume, gives an integrated and up-to-date review of theory and empirical research and offers directions for future study."--Jacket.

A Comprehensive Review of Modern Object Segmentation Approaches: Introduction 2. Traditional Methods in Image Segmentation 3. Deep Models for Semantic Segmentation 4. Deep Models for Instance Segmentation 5. Deep Learning Models for 3D and Video Segmentation 6. Deep Learning Models for Panoptic Segmentation 7. Datasets 8. Evaluation Metrics 9. Challenges and Future Directions 10. Conclusion Acknowledgements References Sep 08 2021 Automated visual recognition tasks such as image classification, image captioning, object detection and image segmentation are essential for image and video processing. Of these, image segmentation is the task of associating pixels in an image with their respective object class labels. It has a wide range of applications within many industries, including healthcare, transportation, robotics, fashion, home improvement, and tourism.In this monograph, both traditional and modern object segmentation

approaches are investigated, comparing their strengths, weaknesses, and utilities. The main focus is on the deep learning-based techniques for the two most widely solved segmentation tasks: Semantic Segmentation and Instance Segmentation. A wide range of deep learning-based segmentation techniques developed in recent years are examined. Various themes emerge from these techniques that push machines to their limits, and often deviate from human perception principles. In addition, an overview of the widely used benchmark datasets for each of these techniques, along with the respective evaluation metrics to measure the models' performances, are presented. Potential future research directions conclude the monograph.This monograph serves as a good introduction to the automated visual recognition task of image segmentation and is intended for students and professionals.

Robust Segmentation and Object Classification in Natural and Medical Images Aug 07 2021 Image segmentation and object classification are two fundamental tasks in computer vision. In this thesis, a novel segmentation algorithm based on deformable model and robust estimation is introduced to produce reliable segmentation

results. The algorithm is extended to handle touching object and partially occluded image segmentation. A multiple class segmentation algorithm is described to achieve multi-class "object cut". The accurate results are achieved using the appearance and bag of keypoints models integrated over mean-shift patches. An affine invariant descriptor is proposed to model the spatial configuration of the keypoints. Besides working with 2D image segmentation problem, a robust, fast and accurate segmentation algorithm is illustrated for processing 4D volumetric data. One-step forward prediction is applied to generate the motion prior based on motion modes learning. Two collaborative trackers are introduced to achieve both temporal consistency and failure recovery. Multi-class classification algorithms using a gentle boosting is used to classify three types of breast cancer. The algorithm is Grid-enabled and launched on the IBM World Community Grid. We will introduce a fast and robust image registration algorithm for both 2D and 3D images. The algorithm starts from an automatic detection of the landmarks followed by a coarse to fine estimation of the nonlinear mapping. The parallelization of the algorithm on the IBM Cell

Broadband Engine (IBM Cell/B.E.) will also be explained in details.

Interactive Co-segmentation of Objects in Image Collections Mar 26 2023 The authors survey a recent technique in computer vision called Interactive Co-segmentation, which is the task of simultaneously extracting common foreground objects from multiple related images. They survey several of the algorithms, present underlying common ideas, and give an overview of applications of object co-segmentation.

Studies in Using Image Segmentation to Improve Object Recognition Aug 27 2020 Abstract: "Recognizing object classes is a central problem in computer vision, and recently there has been renewed interest in also precisely localizing objects with pixel-accurate masks. Since classes of deformable objects can take a very large number of shapes in any given image, a requirement for recognizing and generating masks for such objects is a method for reducing the number of pixel sets which need to be examined. One method for proposing accurate spatial support for objects and features is data-driven pixel grouping through unsupervised image segmentation. The goals of this thesis are to define and address the issues associated with

incorporating image segmentation into an object recognition framework. The first part of this thesis examines the nature of image segmentation and the implications for an object recognition system. We develop a scheme for comparing and evaluating image segmentation algorithms which includes the definition of criteria that an algorithm must satisfy to be a useful black box, experiments for evaluating these criteria, and a measure of automatic segmentation correctness versus human image labeling. This evaluation scheme is used to perform experiments with popular segmentation algorithms, the results of which motivate our work in the remainder of this thesis. The second part of this thesis explores approaches to incorporating the regions generated by unsupervised image segmentation into an object recognition framework. Influenced by our experiments with segmentation, we propose principled methods for describing such regions. Given the instability inherent in image segmentation, we experiment with increasing robustness by integrating the information from multiple segmentations. Finally, we examine the possibility of learning explicit spatial relationships between regions. The efficacy of

these techniques is demonstrated on a number of challenging data sets."

Hypothesis-based Image Segmentation for Object Learning and Recognition May 16 2022

Learning Segmentation from Object Color Oct 29 2020

Hands-On Computer Vision with Detectron2 Jun 17 2022 Computer vision is a crucial component of many modern businesses, including automobiles, robotics, and manufacturing, and its market is growing rapidly. This book helps you explore Detectron2, Facebook's next-gen library providing cutting-edge detection and segmentation algorithms. It’s used in research and practical projects at Facebook to support computer vision tasks, and its models can be exported to TorchScript or ONNX for deployment. The book provides you with step-by-step guidance on using existing models in Detectron2 for computer vision tasks (object detection, instance segmentation, key-point detection, semantic detection, and panoptic segmentation). You’ll get to grips with the theories and visualizations of Detectron2’s architecture and learn how each module in Detectron2 works. As you advance, you’ll build your practical skills by working on two real-life

projects (preparing data, training models, fine-tuning models, and deployments) for object detection and instance segmentation tasks using Detectron2. Finally, you'll deploy Detectron2 models into production and develop Detectron2 applications for mobile devices. By the end of this deep learning book, you'll have gained sound theoretical knowledge and useful hands-on skills to help you solve advanced computer vision tasks using Detectron2.Key Features Learn how to tackle common computer vision tasks in modern businesses with Detectron2 Leverage Detectron2 performance tuning techniques to control the model's finest details Deploy Detectron2 models into production and develop Detectron2 models for mobile devices What you will learn Build computer vision applications using existing models in Detectron2 Grasp the concepts underlying Detectron2's architecture and components Develop real-life projects for object detection and object segmentation using Detectron2 Improve model accuracy using Detectron2's performance-tuning techniques Deploy Detectron2 models into server environments with ease Develop and deploy Detectron2 models into browser and mobile environments Who this book is forIf you are a

deep learning application developer, researcher, or software developer with some prior knowledge about deep learning, this book is for you to get started and develop deep learning models for computer vision applications. Even if you are an expert in computer vision and curious about the features of Detectron2, or you would like to learn some cutting-edge deep learning design patterns, you will find this book helpful. Some HTML, Android, and C++ programming skills are advantageous if you want to deploy computer vision applications using these platforms.

Object Segmentation Using Shape Constraints Jun 05 2021 Segmenting and recognizing objects from images in the presence of noise, clutter and occlusions is an important and challenging problem in computer vision. Strict low-level, bottom-up techniques that address this problem cannot provide good interpretations of images for the purpose of object identification. A solution strategy is to incorporate high-level prior knowledge, such as shape constraints, into existing low-level visual routines, a methodology that this thesis investigates. The thesis provides three approaches that are based on variational approximation, stochastic sampling and dynamic

programming, respectively. The first method applies a shape-based curve-growing model to segment the major pulmonary fissures on thin-section computed tomography. The employed curve-growing process is influenced by both image features and prior knowledge of the shape of the fissures. An adaptive regularization mechanism effectively balances these influences using an entropy measure. The second method identifies target objects in images by using prior information about object shape, represented in a multi-scale curvature form, and by grouping oversegmented image regions. The problem is formulated in a unified probabilistic framework, and image segmentation and object identification are accomplished simultaneously by a stochastic Markov Chain Monte Carlo mechanism. The third method employs Hidden State Shape Models, a variant of Hidden Markov Models, for detecting instances of object classes that exhibit variable shape structure. The term "variable shape structure" is used to characterize object classes in which some object parts can be repeated an arbitrary number of times, some parts can be optional, and some parts can have several alternative appearances. The thesis presents a detection method for finding

instances of such object classes based on dynamic programming. Experimental results for the three proposed methods suggest that effective object segmentation can be achieved by introducing shape constraints.

Range Image Segmentation for 3-D Object Recognition Jul 26 2020

Video Image Segmentation and Object Detection Using Mrf Model Dec 11 2021 In this book, the problem of video object detection has been addressed. The object is detected by integrating the spatial segmentation as well as temporal segmentation. The spatial segmentation of frames has been formulated in spatio-temporal framework. A Compound MRF model is proposed to model the video sequence. This model takes care of the spatial and the temporal distributions as well. Besides taking in to account the pixel distributions in temporal directions, it also model the edges in the temporal direction. This model has been named as edgebased model. The MAP estimates of the labels have been obtained by a hybrid algorithm and is devised by integrating that global as well as local convergent criterion. Similarly temporal segmentation is obtained by a proposed entropy based window growing scheme. The spatial and temporal segmentation

have been integrated to obtain the Video Object Plane (VOP) and hence object detection.

Video Segmentation and Its Applications Apr 03 2021 Video segmentation has become one of the core areas in visual signal processing research. The objective of Video Segmentation and Its Applications is to present the latest advances in video segmentation and analysis techniques while covering the theoretical approaches, real applications and methods being developed in the computer vision and video analysis community. The book will also provide researchers and practitioners a comprehensive understanding of state-of-the-art of video segmentation techniques and a resource for potential applications and successful practice.

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- *Black Magick*
- *Edmentum Assessments Answers*
- *Repaso Answer Key*
- *Breathing Lessons Anne Tyler*
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