Writing the Paper

Abstract, introduction, related work, overview, etc.

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Course materials: `https://mmcheng.net/writing/`

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Fig.: Sections 3.1.-3.5.

Writing the paper

- Divide long sections to sub-sections.
- Each sub-section concentrating on some aspect.
- Help the readers to see what the key ideas are.
- How different parts related to each other?
- Short chunks of information are easier to grasp.

Avoid high expectation on readers!

Abstract: logically a separate document

- As a summarization, write it **after** complete the paper.
- Should repeat some parts of the paper/introduction. Avoid re-use text directly.
- Revise it after any significant change to the paper.

Abstract

- Identify the topic and indicate its importance.
- Briefly explain the ideas, methods, theories, findings.
- Summarise the experimental evidence or theoretical proofs.
- What conclusions to be drawn from the paper.

Abstract: an example

Reliable estimation of visual saliency allows appropriate processing of images without prior knowledge of their contents, and thus remains an important step in many computer vision tasks including image segmentation, object recognition, and adaptive compression. We propose a regional contrast based saliency extraction algorithm, which simultaneously evaluates global contrast differences and spatial coherence. The proposed algorithm is simple, efficient, and yields full resolution saliency maps. Our algorithm consistently outperformed existing saliency detection methods, yielding higher precision and better recall rates, when evaluated using one of the largest publicly available dataset.

Global Contrast based Salient Region Detection, IEEE CVPR 2011.

Introduction: explain the problem

- Start by the problem statement in non-technical way, that can be understood by non-specialists.
- Explain the problem background:
  - Who are potential users?
  - How does your work extend current thinking?
  - Why simple/existing solutions are not adequate?
  - Why is the problem of current interest?
  - What is the challenge of solving the problem?
- Briefly summarize what is the main developments leading to the state-of-the-art before your work.
- Summarise any **assumptions** you make.

Introduction example: problem statement

Humans routinely and effortlessly judge the importance of image regions, and focus attention on important parts. Computationally detecting such salient image regions remains a significant goal, as it allows preferential allocation of computational resources in subsequent image analysis and synthesis. Extracted saliency maps are widely used in many computer vision applications including object-of-interest image segmentation [13, 18], object recognition [25], adaptive compression of images [6], content-aware image editing [28, 33, 30, 9], and image retrieval [4].

Problem statement, importance

Global Contrast based Salient Region Detection, IEEE CVPR 2011.

Introduction example: background

Saliency originates from visual uniqueness, unpredictability, rarity, or surprise, and is often attributed to variations in image attributes like color, gradient, edges, and boundaries. Visual saliency, being closely related to how we perceive and process visual stimuli, is investigated by multiple disciplines including cognitive psychology [26, 29], neurobiology [8, 22], and computer vision [17, 2]. Theories of human attention hypothesize that the human vision system only processes parts of an image in detail, while leaving others nearly unprocessed.

Background in a broader context.

Introduction example: assumptions

Early work by Treisman and Gelade [27], Koch and Ullman [19], and subsequent attention theories proposed by Itti, Wolfe and others, suggest two stages of visual attention: fast, pre-attentive, bottom-up, data driven saliency extraction; and slower, task dependent, top-down, goal driven saliency extraction. We focus on **bottom-up data driven saliency** detection using image contrast. It is widely believed that human cortical cells may be hard wired to preferentially respond to high contrast stimulus in their receptive fields [23]. We propose contrast analysis for extracting high-resolution, full-field saliency maps based on the following observations:

Background and assumptions.

Introduction example: observations

- A global contrast based method, which separates a large-scale object from its surroundings, is preferred over local contrast based methods producing high saliency values at or near object edges.
- Global considerations enable assignment of comparable saliency values to similar image regions, and can uniformly highlight entire objects.
- Saliency of a region depends mainly on its contrast to the nearby regions, while contrasts to distant regions are less significant.
- Saliency maps should be fast and easy to generate to allow processing of large image collections, and facilitate efficient image classification and retrieval.

Introduction: method explain & contributions

- Briefly introduce the main idea of your method.
- **Clearly explain the novelty** w.r.t. existing methods. Also make clear which parts are based on existing ideas.
- Briefly summarise what your experiments demonstrate.

Less/Strong contributions!

Related Work

Purpose of the related work discussion:

- Show that you are **familiar with the area**:
  - What has been done previously.
  - What the current state-of-the-art is.
- Give reviewer **confidence** w.r.t. your claimed novelty.
- Carefully select which work to cite. E.g. Papers which
  - **started** a given line of research;
  - made **major advantages**;
  - ending with current best ideas/results.
- Failed to discuss closely related work can lead to rejection.

More focused/detail than in intro.!

Related Work

Check you are citing the right papers (Google Scholar).

- Highly cited papers are likely to be influential papers that are important in some way.
- Papers with low citations may still be significant, if
  - they have only very recently published,
  - they are on a very specialized topic.

Related Work

Verify the claim your work somehow advances its field.

- You could be the first person to work on a new problem
- It is not good enough to be different, your work must be better in some way.
- Explain the key previous results with critical analysis
  - Point out what its strong points are.
  - Discussing the weakness or limitations.
  - Your work is an improvement or solves a different but related problem.
  - You **do not** have to improve on all aspect.

Credit & critical analysis!

Related Work

- Critical analysis should show how your work is an advance over **all** previous work on the problem.
- Failure to cite significant papers may lead reviewers to conclude that your work is inferior.
- The tools:
  - Your work may rely on existing method as a step.
  - There might be a choice of alternative tools. Briefly analysis them and justify your choice.
- Cite recent survey benchmark paper is helpful.
- It is helpful to put related works in subgroups.

Do not just describing!

Related Work: examples

- Such methods using local contrast tend to produce higher saliency values near edges instead of uniformly highlighting salient objects (see Figure 2).
- Zhai and Shah [32] define pixel-level saliency based on a pixel's contrast to all other pixels. However, for efficiency they use only luminance information, thus ignoring distinctiveness clues in other channels.
- Achanta *et. al.* [2] propose $\cdots$. The elegant approach, however, only considers first order average color, which can be insufficient $\cdots$.
- Furthermore, these methods ignore $\cdots$, which can be critical $\cdots$ (see Section 5).

Overview

An overview before describing details is usually helpful.

- Your idea have many components.
- The components have complex relationships.
- A separate section or include it within the introduction to the paper.

Overview

- Explain the key components
- How they are combined together
- Give the reader a mental map to help them flow the rest of the paper.
- Understand the purpose of each step and how they fit together.
- A diagram may be useful for complex relationship.
- After overview, each novel ideas should be explained in detail in later sections, and unoriginal ideas should be given citations.
- Overview could also provide other background materials (*e.g.* define technical terms or notation), which is necessary to understand your approach.

Overview

- For algorithm, explain which parts are automatic and which require user input.
- Explain under what condition it works.
- Explain where you deviate from standard practice.
- Clearly and explicitly state any assumptions.
- Justify the assumptions are realistic.
- Explain how the assumptions simplify the problem.

Overview: example

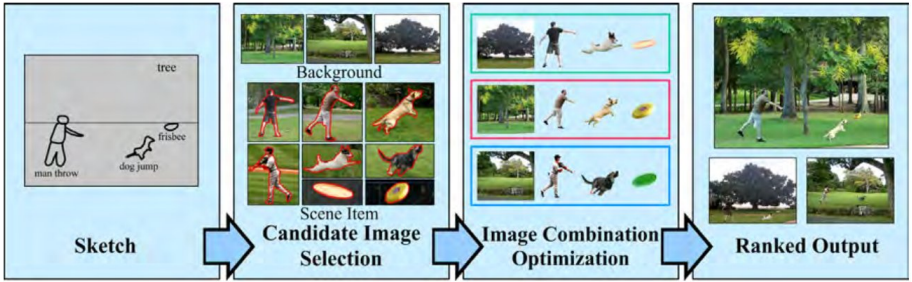
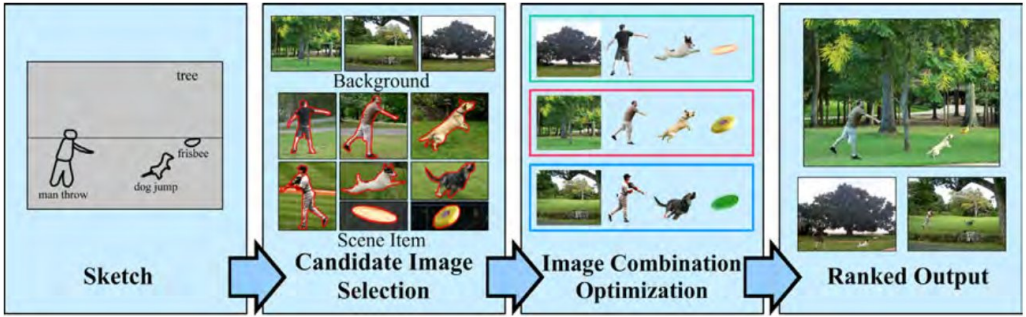


Fig.: Sketch2Photo: Internet Image Montage, ACM TOG 2009.

Fig. 2 provides an overview of our system. The user provides a simple freehand sketch, where each scene item is tagged with a text label. Our goal is to convert this sketch into a photo-realistic image. To achieve this, we search online for each scene item, and the background, using the text label. The discovered results are filtered to exclude undesir-

Overview: example



$\cdots$ During filtering, each image is segmented to find scene elements matching items in the sketch. We then optimize the combination of the filtered images to seamlessly compose them, using a novel image blending technique. Several compositions are automatically generated and ranked according to estimated quality. The user can then select among these results and follow up with interactive refinement.

Overview: example

We introduce a novel pipeline to efficiently detect and extract repeated elements in images, allowing their simultaneous manipulation. Fig. 2 provides an overview of our system. Guided by high level user scribbles, our system detects repeated object instances, which may be subject to deformations, using a novel boundary band method (Fig. 3 and Sec. 4). We subsequently refine the detected object boundaries using an active contour method with shape priors to enforce geometric consistency (Sec. 5).

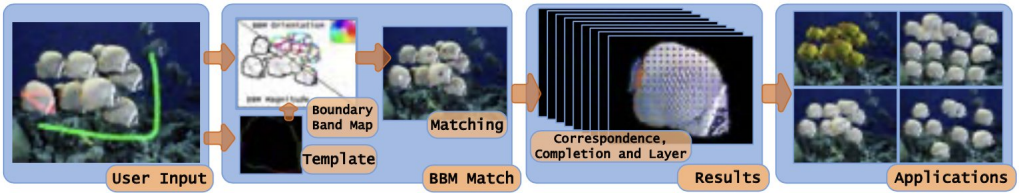
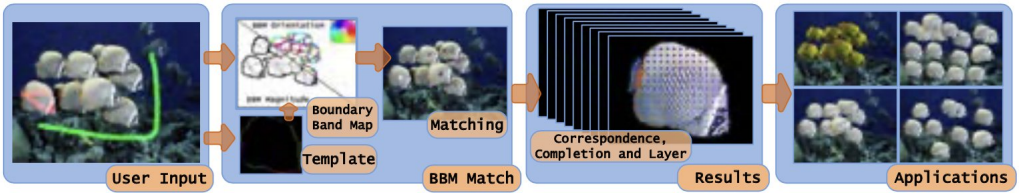


Fig.: RepFinder: Finding Approximately Repeated Scene Elements for Image Editing, ACM TOG 2010.

Overview: example

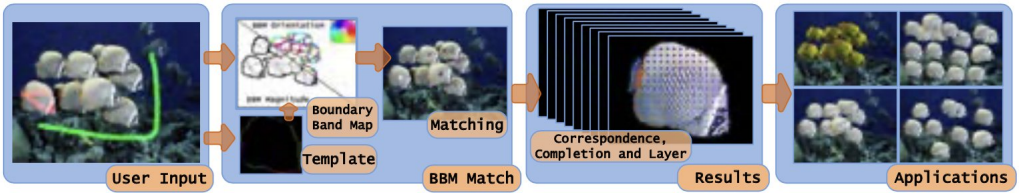
We then estimate the relative depth ordering of pairs of repeated instances and establish a partial ordering across all instances using a topological sort (Sec. 5). Finally, we establish dense correspondence between repeated instances, and complete missing parts of objects.

As an important design choice we designed an edge-based approach for detecting and matching repeated elements, instead of a feature point-based one. For images with repeated elements, and thus many similar feature points, we found point-based SIFT matching to generate too much ambiguity, which is difficult to subsequently resolve.



Overview: example

Our novel system can automatically detect correlation across repeated objects in a designated region of an image, and build an object-level structure, which partially captures the underlying scene semantics. This enables editing operations at the scene object level, instead of at the pixel or patch level. The resulting intuitive and powerful editing operations, which respect geometric and layering relations between image components, are otherwise laborious and difficult to achieve (Sec. 6).



Detail Sections

- The core part of the paper.
- Several sections, each describing some component,
- or giving a theorem which leads up to final result,
- or some key aspect of the work (*e.g.* user input).

Detail Sections: Reproducibility

The ability of readers to test, reproduce and validate your conclusions is the fundamental way in which science progress.

- Should be able to reproduce according to the paper.
- Be able to implement what you have described,
- or follow the steps in your proofs and verify them,
- or collect data of similar kind and analysis it in the same way.

Given enough detail: Reproducibility!

Detail Sections: Common Faults

- Forgot that the readers may not share your background knowledge.
- Go to minor details without explaining the main ideas.
- Forgot explaining how ideas fit together.
- Don't just say what you did and how your method works.
- Explain why you did in this way.
- How each piece of detail fits into the overall solution.
- Summarise in words the ideas conveyed by equations or algorithm.

Less assumption of bkg. knowledge.

Detail Sections: A Simple Recipe

- Start by summarizing what the section is about, what its purpose is, and how it fits with the overall aims.
- Next, give the details themselves.
- Finally, summarise what have been described, demonstrated, proofed, *etc.*.
- Similar plan can also be used in sub-sections, saying how it fits into its section, and so on.

Less assumption of bkg. knowledge.

Homework

Submit 1-2 pages document to discuss and analysis a paper submission and a PPT presentation (1 min with audio). The document should contain: **summary, strength, weakness, and improvements recommendations.** Use LaTeX template `https://www.overleaf.com/read/rzdpjzqwkdwb` and submit at `https://www.wenjuan.com/s/iAJjmen/`.

Deadline: 9th June, 2021

Q & A?