论文阅读与写作

How to read and write scientific paper?

Jiaru Zhang
上海交通大学
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上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

目录

What is Scientific Paper

- Scientific paper is one of the most components/outputs in research
  - Novel
  - Self-contained
  - Reproducible

  If your research does not generate papers, it might just as well not have been done. "Interesting and unpublished" is equivalent to non-existent.

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  If your research does not generate papers, it might just as well not have been done. "Interesting and unpublished" is equivalent to non-existent.
- Compare to other scientific writings
  - Textbook
  - Technical report
  - Weekly report

What is Scientific Paper

- In essence, scientific paper is used for communication between researchers following some kinds of “protocol”

What is Scientific Paper

- In essence, scientific paper is used for communication between researchers following some kinds of “protocol”
- Why need “protocol ”?
  - Large number of published papers
  - Limited time
  - Reducing the difficulties for understanding and producing

What is Scientific Paper

- What is the structure of “protocol”?
  - Title / Abstract: read the paper in 2 minutes
  - Introduction: Motivation, background, storyline, overview
  - Related work: base methods, state-of-the-art methods, competitive methods
  - Main content: formulation, system flow chart, implementation details
  - Experimental results: raw results (figure/table), comparison with other methods
  - Conclusion
  - Reference
- As a researcher, we need read and write papers, following and utilizing the protocol.

The paper *How to read a Paper*

- Just read the paper *How to Read a Paper*.

How to Read a Paper

S. Keshav
David R. Cheriton School of Computer Science, University of Waterloo
Waterloo, ON, Canada
keshav@uwaterloo.ca

ABSTRACT

Researchers spend a great deal of time reading research papers. However, this skill is rarely taught, leading to much wasted effort. This article outlines a practical and efficient *three-pass method* for reading research papers. I also describe how to use this method to do a literature survey.

4. Glance over the references, mentally ticking off the ones you've already read

At the end of the first pass, you should be able to answer the *five Cs*:

The Three-pass Approach

- Pass 1: gives you a general idea about the paper
- Pass 2: lets you grasp the paper's content, but not its details
- Pass 3: helps you understand the paper in depth.

Pass 1

- A quick scan to get a bird's-eye view of the paper
- Time cost: 5 - 10 minutes
- Steps:
  1. Carefully read the title, abstract, and introduction
  2. Read the section and sub-section headings
  3. Read the conclusions
  4. Glance over the references

Pass 1

- At the end of the first pass, five Cs can be answered
- Five Cs:
  1. Category
  2. Context
  3. Correctness
  4. Contributions
  5. Clarity

Pass 2

- Read the paper with greated care
- Time cost: 1 hour
  - Read all main parts
  - Look carefully at the figures, diagrams and other illustrations
  - Mark relevant unread references

Pass 2

- After Pass 2, you could
  - Grasp the content of the paper
  - Summarize the main thrust with evidence to others
- What if still not understand?
  - Set the paper aside
  - Return to the paper later
  - Go to Pass 3

Pass 3

- Fully understand the paper.
- Virtually re-implementation
- Time cost: 1 hour - 5 hours
  - Identify and challenge every assumption
  - Think how to present the idea
  - Think the proof and presentation techniques

Practice

- Please search for my paper *Improving Bayesian Neural Networks by Adversarial Sampling* and try the Pass 1 reading on it.

Source of Paper Writing

- Introduction: from new idea proposal
- Experimental results: raw results from daily log and weekly report; comparison from paper reading
- Main content: formulation from proposal / weekly discussion; implementation details from daily log and weekly report
- Related work / Reference: from paper reading
- Title / Abstract / Conclusion: ideally, the only content you should write before submission deadline

Hands-on tips for paper writing

- How to find a proper title?
  - Find keywords: field/problem, new concept/methods
  - Connect all the keywords
  - Modify it

Hands-on tips for paper writing

- How to find a proper title?
  - Domain words + Technique words + Constraint/Description words
    - Improving Bayesian Neural Networks by Adversarial Sampling
    - Deep Metric Learning by Online Soft Mining and Class-Aware Attention

Hands-on tips for paper writing

- How to write a concise but eye-catching abstract?
- An abstract should cover all major contents, e.g., background, main approaches and results of the paper.
  - Part 1: background / problem definition / existing methods and limitations (2-3 sentences)
  - Part 2: proposed the method / main structure / contributions (1 + 2-4 sentences)
  - Part 3: evaluation dataset / experimental results (2-3 sentences)

Hands-on tips for paper writing

- How to write a concise but eye-catching abstract?
- Example: background / problem definition / existing methods and limitations (2-3 sentences)

  Bayesian neural networks (BNNs) have drawn extensive interest due to the unique probabilistic representation framework. However, Bayesian neural networks have limited publicized deployments because of the relatively poor model performance in real-world applications.

Hands-on tips for paper writing

- How to write a concise but eye-catching abstract?
- Example: proposed the method / main structure / contributions (1 + 2 - 4 sentences)

  In this paper, we argue that the randomness of sampling in Bayesian neural networks causes errors in the updating of model parameters during training and poor performance of some sampled models in testing. To solve this, we propose to train Bayesian neural networks with Adversarial Distribution as a theoretical solution. To avoid the difficulty of calculating Adversarial Distribution analytically, we further present the Adversarial Sampling method as an approximation in practice.

Hands-on tips for paper writing

- How to write a concise but eye-catching abstract?
- Example: evaluation dataset / experimental results (2-3 sentences)

  We conduct extensive experiments with multiple network structures on different datasets, e.g., CIFAR-10 and CIFAR-100. Experimental results validate the correctness of the theoretical analysis and the effectiveness of the Adversarial Sampling on improving model performance. Additionally, models trained with Adversarial Sampling still keep their ability to model uncertainties and perform better when predictions are retained according to the uncertainties, which further verifies the generality of the Adversarial Sampling approach.

Hands-on tips for paper writing

- How to write the instruction section?
- An extended version of abstract
  - Background
  - Recent development
  - Existing problem
  - Our solution
  - Main contributions
  - (Optional) Structure of the paper

Hands-on tips for paper writing

- How to write the related work section?
- Classify the reference properly
  - Work related to the Field : Bayesian neural network history, existing exploration on the problem
  - Work related to the Solution: Adversarial Perturbation
- Use 1-3 sentences to describe one paper usually
- Use correct tense
  - Use past tense to mention the authors'contribution
  - Use present tense to describe the general truth
- (Optional but highly recommended) Try to connect /clarify your paper with proper related work

Hands-on tips for paper writing

- How to write the background section?
- Note that the background section is not necessary
- List relevant definitions, formulations, theorems, derivations
- Do not put the proposals or irrelevant materials here

Hands-on tips for paper writing

- How to write the methodology section?
- Demonstrate your proposals
- Theoretical analysis, theorems, proof or proof overview
- Practical operations, frameworks

Hands-on tips for paper writing

- How to write the experiments section?
- Datasets, settings, baselines
- Evaluation metrics
- Implementation details
- Ablation study
- Comparison to the state-of-the-arts

Figures and Tables

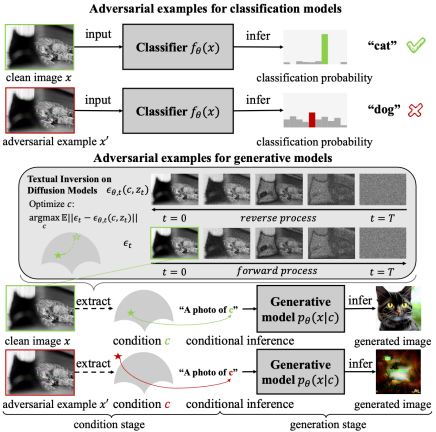
- General figure types
  - motivation figure
  - overall system structure
  - key component illustration figure
  - performance figure
  - quantitative figure
- General table types
  - overall performance table
  - ablation study table

Figures and Tables

- Figures and Tables
- One picture is worth one thousand words
- General rule of preparing a figure
  - self-contained
  - simple but deliver the major information
  - clear to read

Figures and Tables

- Example of figures: motivation figure



Figures and Tables

- Example of figures: overall system structure

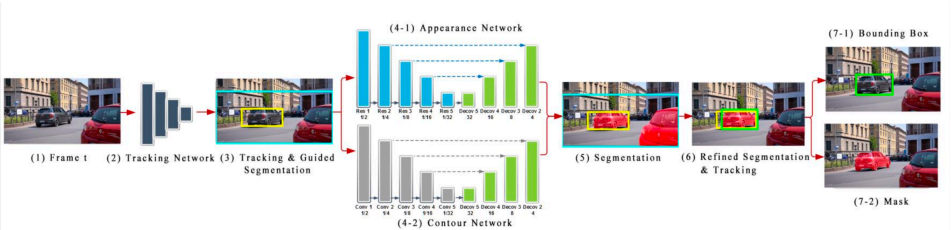


Figure 2: Tracking-assisted Weakly Supervised Segmentation Framework: (1) Input frame t. (2) A general tracking module, adopted from ECO [10]. (3) The tracker first helps to guide the segmentation. The yellow bounding box represents the predicted target position and size by tracker, while the cyan bounding box represents the area that is cropped for segmentation. (4) Segmentation module contains appearance network and contour network. (5) Initial segmentation results indicating with the red mask. (6) Tracking output and segmentation results help refine each other mutually. (7) Finally, two outputs are given, a bounding box for tracking, and a mask for segmentation. *Best viewed in color.*

Figures and Tables

- Example of figures: key component illustration

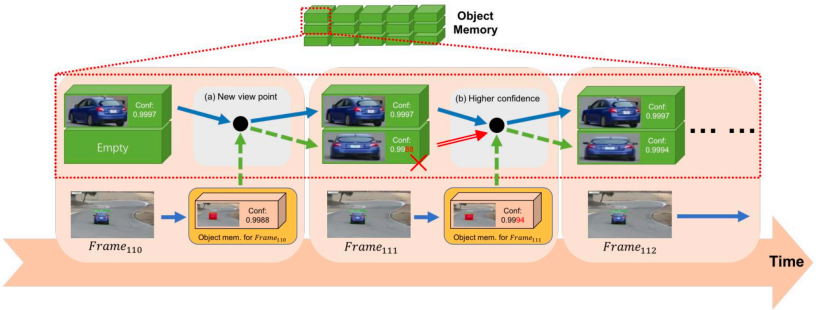


Figure 2. Maintenance of *object memory*. Three update examples are illustrated. First, preserving of high quality feature. Before frame 110, an object feature representing the side of a car is in *object memory*, which is extracted from remote frame. Second, new object feature written to the memory. After detection on frame 110, a new car feature dissimilar to existing memory features is written to $objectmemory$, although the classification of the new object is lower. Third, removal of redundant object feature. A new feature also representing the back side of a car is detected in frame 111 with higher classification score. The old feature extracted from frame 110.

Figures and Tables

- Examples of figure: quantitative results

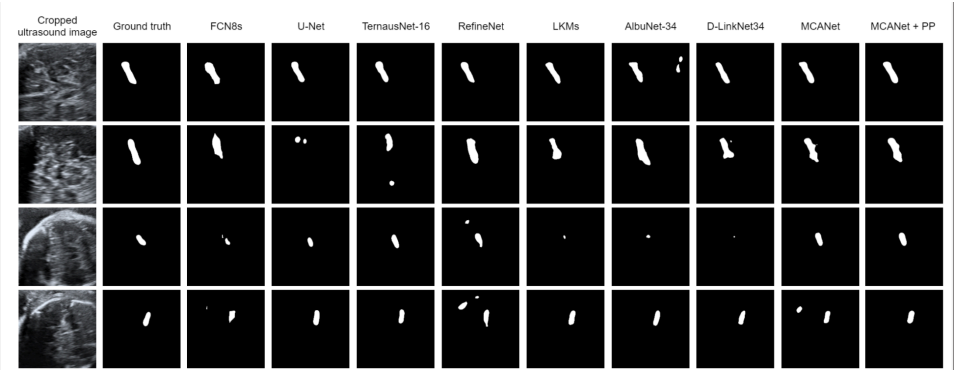


Fig. 3. Visual segmentation results of different models. These input images in the first column are cropped from raw ultrasound images for displaying detailed context of MCA and corresponding predictions (PP denotes post processing).

Figures and Tables

- General rule of preparing a table
  - self-contained
  - performance increase or decrease
  - style of table
  - high-lighting the content
  - citation

Figures and Tables

- Examples of table

	θ_{UCM}	Training Steps N	With mask selection?	$\mathcal{J}$
SimpleDoesIt [1]	/	/	/	67.2
Grabcut [34]	/	/	/	58.6
Ours	0.4	50	✓	84.1
	0.6	50	✓	83.2
	Dy.	5	✓	84.4
	Dy.	100	✓	83.1
	Dy.	50		66.5
	Dy.	50	✓	**84.6**

Hands-on tips for paper writing

- How to prepare a reference and bibtex file?
- Follow the requirements from the conference or journal
- Update information of arXiv paper if it has been published
- Use abbreviation for conference while keep full information for journal papers
- Examples:
  - Madry, A.; Makelov, A.; Schmidt, L.; Tsipras, D.; and Vladu, A. 2018. Towards Deep Learning Models Resistant to Adversarial Attacks. In ICLR.
  - Bardenet, R.; Doucet, A.; and Holmes, C. 2017. On Markov Chain Monte Carlo Methods for Tall Data. The Journal of Machine Learning Research, 18(1): 1515—1557.

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