# Researching Responsible and Trustworthy Natural Language Processing

Session 4: Scientific Writing: Structure

Frank Keller

27 September 2024

School of Informatics
University of Edinburgh
keller@inf.ed.ac.uk

# Overview

Title

Introduction

Middle

Conclusion

Reading: Alley (2018), Chapter 7.

Please also look at Alley's web site, which has a lot of videos and additional materials: https://www.craftofscientificwriting.org/

# Organizing Content

Scientific documents are almost always structured as:

- Title
- Introduction
- Middle
- Conclusions

The structure of the middle can vary. In experimental papers, it's typically:

- Method
- Results
- Discussion

We will discuss abstract, appendices, figures and tables separately.

# Title

# Homework from Last Time

Remember the paper we discussed in the last session (Vaswani et al., 2017):

Attention Is All You Need

Let's discuss your homework:

1. Re-write the title of this paper.
2. Write a proper caption for Figure 1 (next page).

# Homework from Last Time

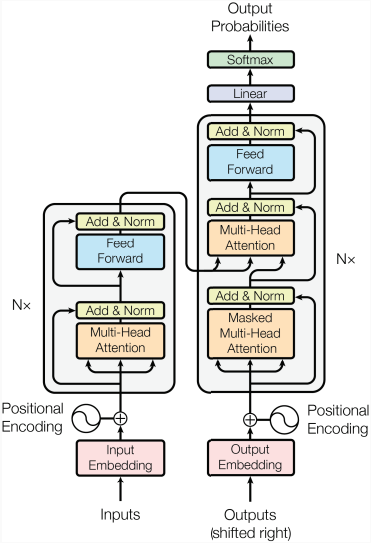


Figure 1: The Transformer - model architecture.

# Title

How to write titles:

- "short and sweet" is great advice for the title of novels, but it doesn't work well for titles of scientific papers
- the title should enable the audience to decide whether to read the paper or not
- in a bibliography or a web search readers will *only* see the title
- use the title to specify the scope of the document: identify the field of work and separate it from others in the field

## Title: Examples

The Bluest Eye.

Sula.

Song of Solomon.

Tar Baby.

Beloved.

Jazz.

Paradise.

Love.

A Mercy.

Home.

God Help the Child.

## Title: Examples

The Bluest Eye.
Sula.
Song of Solomon.
Tar Baby.
Beloved.
Jazz.
Paradise.
Love.
A Mercy.
Home.
God Help the Child.

Titles of novels of Tony Morrison (Nobel Prize in Literature, 1993).

# Title: Examples from ACL 2024

Titles don't have to be phrases, they can be sentences:

Speech language models lack important brain-relevant semantics

This title is a one-sentence summary of the result of the study. In some fields (e.g., medicine), this is the conventional way to write titles.

It's also common to combine a main title and a subtitle, separated by a colon:

Self-Alignment for Factuality: Mitigating Hallucinations in LLMs via Self-Evaluation

Here, the main title introduces the method, and the subtitle the task.

# Title: Examples from ACL 2024

Pride and Prejudice: LLM Amplifies Self-Bias in Self-Refinement

Language Models are Homer Simpson! Safety Re-Alignment of Fine-tuned Language Models through Task Arithmetic

Multimodal Table Understanding

Graph Language Models

Tracking the Newsworthiness of Public Documents

SpaRC and SpaRP: Spatial Reasoning Characterization and Path Generation for Understanding Spatial Reasoning Capability of Large Language Models

PokeMQA: Programmable knowledge editing for Multi-hop Question Answering

Speech vs. Transcript: Does It Matter for Human Annotators in Speech Summarization?

# Introduction

# Introduction

The introduction prepares the reader for the main content of the document, answering the following questions:

- What exactly is the work?
- Why is the work important?
- What is needed to understand the work?
- How will the work be presented?

Not all question may be present, and not always in this order.

## What exactly is the work?

- Describe the scope and limitations of the work.
- Provide more detail than the abstract.
- State any underlying theoretical or methodological assumptions.

# Why is the work important?

- Give the audience a reason to starting reading, and continue reading, the document.
- If the document is a proposal: why should this be funded?
- The importance of the work can derive from its applications, but also from pure curiosity.
- In that case, you need to instill this curiosity in the reader!
- Bear in mind who your *audience* is: experts, general readers, funders, managers.
- This determines how you need to justify the importance of your work.

# Why is the work important?

In size, density, and composition, Ganymede and Callisto (Jupiter's two largest moons) are near twins: rock-loaded snowballs. These moons are about 5000 km in diameter and contain 75 percent water by volume. The one observable difference between them is their albedo: Callisto is dark all over, while Ganymede has dark patches separated by broad light streaks. This paper discusses how these two similar moons evolved so differently.

Here curiosity is the main motivation for the work.

## What is needed to understand the work?

Present the background required to understand the main part of your document:

- review literature and related work
- show that your work is novel, unique
- identify gaps in the literature (respectfully!)
- tailor this to your audience and what they know
- boost your credibility as an author

Can be a separate section or chapter, or just a part of the intro.

In a thesis, you can have both an upfront background chapter and a background section for each content chapter.

# What is needed to understand the work?

A table is sometimes a good way to present the related literature:

| Dataset | Task | #L | #V | Obj | Imgs | Sen | Des | Cln | ML | Resource | Example Labels |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ikizler (Ikizler et al., 2008) | AC | 6 | 6 | 0 | 467 | N | N | Y | N | – | running, walking |
| Sports Dataset (Gupta et al., 2009) | AC | 6 | 6 | 4 | 300 | N | N | Y | N | – | tennis serve, cricket bowling |
| Willow (Delaitre et al., 2010) | AC | 7 | 6 | 5 | 986 | N | N | Y | Y | – | riding bike, photographing |
| PPMI (Yao and Fei-Fei, 2010) | AC | 24 | 2 | 12 | 4.8k | N | N | Y | N | – | play guitar, hold violin |
| Stanford 40 Actions (Yao et al., 2011) | AC | 40 | 33 | 31 | 9.5k | N | N | Y | N | – | cut vegetables, ride horse |
| PASCAL 2012 (Everingham et al., 2015) | AC | 11 | 9 | 6 | 4.5k | N | N | Y | Y | – | riding bike, riding horse |
| 89 Actions (Le et al., 2013) | AC | 89 | 36 | 19 | 2k | N | N | Y | N | – | ride bike, fix bike |
| MPII Human Pose (Andriluka et al., 2014) | AC | 410 | – | 66 | 40.5k | N | N | Y | N | – | riding car, hair styling |
| TUHOI (Le et al., 2014) | HOI | 2974 | – | 189 | 10.8k | N | N | Y | Y | – | sit on chair, play with dog |
| COCO-a (Ronchi and Perona, 2015) | HOI | – | 140 | 80 | 10k | N | Y | Y | Y | VerbNet | walk bike, hold bike |
| Google Images (Ramanathan et al., 2015) | AC | 2880 | – | – | 102k | N | N | N | N | – | riding horse, riding camel |
| HICO (Chao et al., 2015) | HOI | 600 | 111 | 80 | 47k | Y | N | Y | Y | WordNet | ride#v#1 bike; hold#v#2 bike |
| VCOCO-SRL (Gupta and Malik, 2015) | VSRL | – | 26 | 48 | 10k | N | Y | Y | Y | – | verb: hit; instr: bat; obj: ball |
| imSitu (Yatskar et al., 2016) | VSRL | – | 504 | 11k | 126k | Y | N | Y | N | FrameNet<br>WordNet | verb: ride; agent: girl#n#2<br>vehicle: bike#n#1;<br>place: road#n#2 |
| VerSe (Gella et al., 2016) | VSD | 163 | 90 | – | 3.5k | Y | Y | Y | N | OntoNotes | ride.v.01, play.v.02 |
| Visual Genome (Krishna et al., 2016) | VRD | 42.3k | – | 33.8k | 108k | N | N | Y | Y | – | man playing frisbee |

From Gella and Keller (2017).

# Over to You

# Exercise 1

Let's again look at the introduction of Vaswani et al. (2017) (next page):

- What exactly is the work?
- Why is the work important?
- What is needed to understand the work?
- How will the work be presented?

Which of these questions are present in this excerpt?

# Exercise 1

Recurrent neural networks, long short-term memory [13] and gated recurrent [7] neural networks in particular, have been firmly established as state of the art approaches in sequence modeling and transduction problems such as language modeling and machine translation [35, 2, 5]. Numerous efforts have since continued to push the boundaries of recurrent language models and encoder-decoder architectures [38, 24, 15].

Recurrent models typically factor computation along the symbol positions of the input and output sequences. Aligning the positions to steps in computation time, they generate a sequence of hidden states $h_t$, as a function of the previous hidden state $h_{t-1}$ and the input for position $t$. This inherently sequential nature precludes parallelization within training examples, which becomes critical at longer sequence lengths, as memory constraints limit batching across examples.

In this work we propose the Transformer, a model architecture eschewing recurrence and instead relying entirely on an attention mechanism to draw global dependencies between input and output. The Transformer allows for significantly more parallelization and can reach a new state of the art in translation quality after being trained for as little as twelve hours on eight P100 GPUs.

# Middle

# Middle

The middle of a document presents the work in a logical and persuasive fashion. To achieve this, choose a *strategy* for presenting the material:

- chronological
- spatial
- classification and division
- cause-effect
- comparison-contrast

The strategy you choose must be suitable for the audience. Use it to group the work in sections, to make it more digestible.

# Descriptive Headings

Section headings should be descriptive, make the strategy of the document obvious, serve as a roadmap for the reader.

Sections provide *whitespace,* which allows readers:

- pause and reflect on what they've read
- jump to the information that interests them, skip those parts that don't

Don't over-section the text, consider if a paragraph break is better than introducing a subsection.

# Descriptive Headings

Stylistic considerations for section headings:

- avoid cryptic one-word titles also for sections
- use parallelism (all subsections are titled using noun phrases, participles, etc)
- Don't use dangling subsections (1, 2, 2.1, 3, 3.1, 3.2, 4)

Look at the **table of content** to see if your sectioning works.

Put `\tableofcontent` at the beginning of your paper (even if the final version won't have a ToC).

# Descriptive Headings

**Weak Headings**

Introduction
Debris Recovered
Cataloguing
Interpretation
Results
- Placement
- Bomb Makeup

Work to be Done
- Interpretation

**Strong Headings**

Introduction
Completed Work
- Recovering Debris
- Cataloguing Debris
- Interpreting the Debris

Preliminary Results of Work
- Placement of Bomb
- Construction of Bomb

Future Work

# Depth

Depth is the level of detail in your document. Affected by:

- **occasion:** determines length, e.g., conference paper vs. journal article
- **audience:** satisfy the readers interest, anticipate their questions, don't raise questions the document doesn't answer
- **purpose:** if you want to persuade, you will need to discuss advantages and disadvantages, rebut objections, etc.

Adapt paragraph and section length depending on the depth of your document.

Avoid very long or very short paragraphs (exception: instructions).

# Over to You

# Exercise 2

Here's the sectioning of the Vaswani et al. (2017) paper:

1. Introduction
2. Background
3. Model Architecture
   - 3.1 Encoder and Decoder Stacks
   - 3.2 Attention
     - 3.2.1 Scaled Dot-Product Attention
     - 3.2.2 Multi-Head Attention
     - 3.2.3 Applications of Attention in our Model
   - 3.3 Position-wise Feed-Forward Networks
   - 3.4 Embeddings and Softmax
   - 3.5 Positional Encoding
4. Why Self-Attention

# Exercise 2

5. Training
   - 5.1 Training Data and Batching
   - 5.2 Hardware and Schedule
   - 5.3 Optimizer
   - 5.4 Regularization
6. Results
   - 6.1 Machine Translation
   - 6.2 Model Variation
   - 6.3 English Constituency Parsing
7. Conclusion

Which *strategy* do the authors use to structure the middle? Do they follow Alley's advice on *sectioning?* Are the headings *descriptive?* Which level of *depth* do they us?

# Conclusion

# Conclusion

Summarizes the middle and provides a future perspective:

- provide an analysis of the most important results
- analyze the results overall, not individually (do that in the middle, in a Discussion section)
- do not present new evidence or new results here
- provide a future perspective:
  - recommendations that derive from your work
  - future direction of you work
  - re-iterate the scope and limitations of your work (already in the intro)
- ACL conferences now require a separate section on limitations

Conclusion ties together loose ends, provides closure.

# References


Alley, Michael. 2018. *The Craft of Scientific Writing*. Springer, New York, NY, 4 edition.

Gella, Spandana and Frank Keller. 2017. An analysis of action recognition datasets for language and vision tasks. In *Proceedings of the 55th Annual Meeting of the Association for Computational Linguistics, Volume 2: Short Papers*. Vancouver, pages 64–71.

Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N Gomez, Łukasz Kaiser, and Illia Polosukhin. 2017. Attention is all you need. In I. Guyon, U. V. Luxburg, S. Bengio, H. Wallach, R. Fergus, S. Vishwanathan, and R. Garnett, editors, *Advances in Neural Information Processing Systems 30*. Curran Associates, Red Hook, NY, pages 5998–6008.