Hopefully-Reusable

Life Lessons for PhD Students in NLP

Vered Shwartz

dair.ai Women In NLP meetup, May 2021
About Me

Bio:
• Postdoc @ Allen Institute for AI (AI2) & the University of Washington
• Previously: PhD @ Bar-Ilan University
• Fall 2021: Assistant Professor @ the University of British Columbia
My Work:

Commonsense Reasoning in NLP
Is Natural Language Understanding Nearly Solved?
Is Natural Language Understanding Nearly Solved?

- Pre-training
- Syntax
- Word meanings
- Factual Knowledge
- ...

Google AI
Wikipedia
The Free Encyclopedia
Is Natural Language Understanding Nearly Solved?

- Pre-training
  - Wikipedia: The Free Encyclopedia
  - Google AI

- Fine-tuning:
  - Language Model

- ✔️ Syntax
- ✔️ Word meanings
- ✔️ Factual Knowledge
- ✔️ ...

- ✅ Syntax
- ✅ Word meanings
- ✅ Factual Knowledge
- ✅ ...

Diagram shows the process of pre-training with external knowledge sources followed by fine-tuning to create a language model.
Is Natural Language Understanding Nearly Solved?

Pre-training:
- Syntax
- Word meanings
- Factual Knowledge
- ...

Fine-tuning:

Language Model

The chocolate cake is amazing
Is Natural Language Understanding Nearly Solved?

Pre-training

Language Model

Fine-tuning:

- Syntax
- Word meanings
- Factual Knowledge
- ...

5.4% 94.6%

The chocolate cake is amazing
Is Natural Language Understanding Nearly Solved?

Pre-training

- Syntax
- Word meanings
- Factual Knowledge
- ...

WIKIPEDIA

The Free Encyclopedia

细

Google AI

Fine-tuning:

Language Model

The chocolate cake is amazing

- Understanding the task
- Learning to solve the task

5.4% 94.6%
Is Natural Language Understanding Nearly Solved?

Pre-training

✅ Syntax
✅ Word meanings
✅ Factual Knowledge
✅ ...

Fine-tuning:

Language Model

The chocolate cake is amazing

✔️ Understanding the task
✔️ Learning to solve the task

What are the remaining challenges?

❓ Generalization to unknown situations
Overfitting to Data-specific Spurious Correlations
Overfitting to Data-specific Spurious Correlations

阿里巴巴: A horse standing in the grass.
(Szegedy et al., 2015)
Overfitting to Data-specific Spurious Correlations

🔍: A horse standing in the grass.

(Szegedy et al., 2015)
Overfitting to Data-specific Spurious Correlations

🤖: A horse standing in the grass.
(Szegedy et al., 2015)

How many zebras?

 العليا: 2
(Agrawal et al., 2016)
Overfitting to Data-specific Spurious Correlations

How many zebras? 2

How many dogs? 2

How many giraffes? 2

🤖: A horse standing in the grass. (Szegedy et al., 2015)

How many zebras? 2

(Agrawal et al., 2016)
Overfitting to Data-specific Spurious Correlations

- **How many zebras?**
  - 🐨: 2
    - (Agrawal et al., 2016)
  - 🐪: A horse standing in the grass.
    - (Szegedy et al., 2015)

- **How many dogs?**
  - 🐾: 2

- **How many giraffes?**
  - 🦒: 2

---

**p:** I only had a soup but it was very filling.

**h:** I *didn't* eat a salad.

- 🤖: contradiction (91.7%)

- (Gururangan, Swayamdipta et al., 2018; Poliak et al., 2018)
Overfitting to Data-specific Spurious Correlations

How many zebras? 2
(Agrawal et al., 2016)

How many giraffes? 2

How many dogs? 2

How many giraffes? 2

A horse standing in the grass.
(Szegedy et al., 2015)

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I only had a soup but it was very filling.
I didn't eat a salad.

contradiction

The boy ran in the park.
The boy didn't run in the park.
contradiction

How many dogs? 2

...Solving datasets but not underlying tasks!
Addressing Unknown Situations with Commonsense
# Addressing Unknown Situations with Commonsense

## Translation

<table>
<thead>
<tr>
<th>ENGLISH - DETECTED</th>
<th>HEBREW</th>
<th>HEBREW</th>
<th>ENGLISH</th>
<th>SPANISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>grass-fed yogurt</td>
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Addressing Unknown Situations with Commonsense

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Reading Comprehension

Stevie Wonder announces he’ll be having kidney surgery during London concert
Addressing Unknown Situations with Commonsense

Chatbots

Medical chatbot using OpenAI’s GPT-3 told a fake patient to kill themselves.

Translation

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= yogurt with grass

Reading Comprehension

Stevie Wonder announces he’ll be having kidney surgery during London concert
What is Commonsense?

The basic level of **practical knowledge** and **reasoning** concerning **everyday situations** and **events** that are **commonly** shared among **most** people.

*Introductory Tutorial on Commonsense Reasoning*: Maarten Sap, Vered Shwartz, Antoine Bosselut, Dan Roth, and Yejin Choi. ACL 2020.
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...
#1: Implicit Meaning in Noun Compounds


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Oil made of olives


#1: Implicit Meaning in Noun Compounds


#1: Implicit Meaning in Noun Compounds

**oil made of olives**

*IF OLIVE OIL IS MADE FROM OLIVES...*

*THEN THAT MUST MEAN BABY OIL IS MADE FROM...*

**oil used for babies**


*Paraphrase to Explicate: Revealing Implicit Noun-Compound Relations. Vered Shwartz and Ido Dagan. ACL 2018.*
Children need to eat more vegetables because they are healthy.
#2: Introspective Knowledge Discovery

Children need to eat more vegetables because they are healthy.
Children need to eat more vegetables because they are healthy.

What are the properties of vegetables?

Self-Inquiry

Neural Language Model

Children need to eat more vegetables because they are healthy.

Self-Inquiry:
What are the properties of vegetables?

Existing Knowledge:
Vegetables are full of vitamins.

Children need to eat more vegetables because they are healthy.

What are the properties of vegetables?

Vegetables are full of vitamins.

#3: Nonmonotonic Reasoning

Abductive reasoning
- Most plausible explanation

Counterfactual reasoning
- What if?

Defeasible reasoning
- Updating inferences with additional knowledge
#3: Nonmonotonic Reasoning

Abductive reasoning

Most plausible explanation
Sara wanted to make dinner for some guests.
#3: Nonmonotonic Reasoning

Abductive reasoning

Most plausible explanation

Sara wanted to make dinner for some guests.

She had to order pizza for her friends instead.
#3: Nonmonotonic Reasoning

Abductive reasoning

Most plausible explanation

Sara wanted to make dinner for some guests.

But she didn’t know how to cook.

She had to order pizza for her friends instead.
#3: Nonmonotonic Reasoning

Defeasible reasoning

Updating inferences with additional knowledge
#3: Nonmonotonic Reasoning

Defeasible reasoning

Updating inferences with additional knowledge
#3: Nonmonotonic Reasoning

Defeasible reasoning

P: Tweety is a bird.

Updating inferences with additional knowledge
Nonmonotonic Reasoning

**P:** Tweety is a bird.

**H:** Tweety flies.

Defeasible reasoning

Updating inferences with additional knowledge
Nonmonotonic Reasoning

P: Tweety is a bird.
H: Tweety flies.
Weakener: Tweety is a penguin.

Defeasible reasoning

Updating inferences with additional knowledge
#3: Nonmonotonic Reasoning

P: Tweety is a bird.

H: Tweety flies.

Weakener: Tweety is a penguin.

Strengthener: Tweety is on a tree.
Challenge: Acquiring Commonsense Knowledge

1 from people

2 from text
Challenge: Acquiring Commonsense Knowledge

1. from people
2. from text

✗ Impossible to manually enumerate

$\$\$\$
Challenge: Acquiring Commonsense Knowledge

1. from people
   - Impossible to manually enumerate
   - Reporting bias
     (Gordon and Van Durme, 2013)

2. from text

Graph:
- Murdered + killed
- Breathed + exhaled + inhaled
Challenge: Acquiring Commonsense Knowledge

1. from people
   - Impossible to manually enumerate

2. from text
   - Reporting bias
     (Gordon and Van Durme, 2013)

3. from large-scale neural language models
Acquiring Commonsense Knowledge from Large-scale Neural Language models
Acquiring Commonsense Knowledge from Large-scale Neural Language models

✓ Capture facts not explicitly mentioned in the corpus
(Petroni et al. 2019; Feldman et al. 2019)
Acquiring Commonsense Knowledge from Large-scale Neural Language models

✔ Capture facts not explicitly mentioned in the corpus (Petroni et al. 2019; Feldman et al. 2019)

✗ Not sensitive to negation (Kassner et al. 2020; Ettinger, 2020)
Acquiring Commonsense Knowledge from Large-scale Neural Language models

☑ Capture facts not explicitly mentioned in the corpus (Petroni et al. 2019; Feldman et al. 2019)

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✗ Don’t differentiate constant vs. contingent facts

Zebras are black and white. My shirt is blue / red.
Acquiring Commonsense Knowledge from Large-scale Neural Language models

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Don’t differentiate generic facts from grounded knowledge about named entities

"You are grounded!": Latent Name Artifacts in Pre-trained Language Models. Vered Shwartz, Rachel Rudinger, and Oyvind Tafjord. EMNLP 2020.
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- Don’t differentiate generic facts from grounded knowledge about named entities
  - Richard has a bad habit of saying things that are not true.
  - Donald has a bad reputation for being a racist.

- Don’t completely overcome reporting bias
  - The man turned on the faucet. As a result,

Zebra images: Zebras are black and white. My shirt is blue / red.

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- Don’t differentiate constant vs. contingent facts
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- Don’t completely overcome reporting bias
- Don’t differentiate generic facts from grounded knowledge about named entities

Zebras are black and white. My shirt is blue / red.

Richard has a bad habit of saying things that are not true.
Donald has a bad reputation for being a racist.

The man turned on the faucet. As a result, the man’s blood was sprayed everywhere.

"You are grounded!": Latent Name Artifacts in Pre-trained Language Models. Vered Shwartz, Rachel Rudinger, and Oyvind Tafjord. EMNLP 2020.
Acquiring Commonsense Knowledge

Learning Commonsense Knowledge from Text
Acquiring Commonsense Knowledge from Text, Images and Videos
Acquiring Commonsense Knowledge

Learning Commonsense Knowledge from Text

from Text, Images and Videos

Reporting Bias!

last row ⇒ standing

front row ⇒ cross-legged
Acquiring Commonsense Knowledge

Learning Commonsense Knowledge from Text

Reporting Bias!

Hanging up the phone without saying goodbye

Reporting Bias!
Acquiring Commonsense Knowledge

Learning Commonsense Knowledge from Text

Reporting Bias!

Hanging up the phone without saying goodbye

Reporting Bias!
Life Lessons for PhD Students in NLP
Be Yourself.

Stay away from what “everyone is working on”

(unless you are willing to live under constant fear of being scooped)
Be Yourself.

Stay away from what “everyone is working on”

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Stay away from what “everyone is working on”

What is your unique contribution?
What problems interest you?

(unless you are willing to live under constant fear of being scooped)

Be yourself; Everyone else is already taken.

-Oscar Wilde
Choose your problems carefully.
Choose your problems carefully.

- Conference deadlines encourage working towards smaller goals.
Choose your problems carefully.

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- Don’t work on too many low hanging fruit.
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- Conference deadlines encourage working towards smaller goals.
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  - But also don’t wait until you solve NLP to publish
Choose your problems carefully.

- Conference deadlines encourage working towards smaller goals.
- Don’t work on too many low hanging fruit.
- Don’t submit half-baked work.
- But also don’t wait until you solve NLP to publish.

- Choose quality over quantity. No one cares who published the most first authored papers.

Source: Marek Rei
Don’t reinvent the wheel.

Reading rots the mind
Don’t reinvent the wheel.

Reading *rots the mind* saves you time and heartbreak.
Don’t reinvent the wheel.

Reading *rots the mind* saves you time and heartbreak.

- Most of us are not creative geniuses! You are likely to reinvent ideas that have already been published (best case) or that have failed (worst case).
Don’t reinvent the wheel.

Reading rot\textsuperscript{\textsubscript{s}} the mind saves you time and heartbreak.

- Most of us are not creative geniuses! You are likely to reinvent ideas that have already been published (best case) or that have failed (worst case).
- Do a thorough literature review and figure out the gaps in existing work.
Don’t reinvent the wheel.

Reading **rots the mind** saves you time and heartbreak.

- Most of us are not creative geniuses! You are likely to reinvent ideas that have already been published (best case) or that have failed (worst case).
- Do a thorough literature review and figure out the gaps in existing work.
- Don’t read **every** paper on arXiv. Stay focused and read more narrowly than widely (with exceptions).
Don’t Overwork.

Work is important but so is personal life.
Don’t Overwork.

Work is important but so is personal life.

• Set work time boundaries to exceed only on special occasions (e.g. deadlines).
Don’t Overwork.

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Don’t Overwork.

Work is important but so is personal life.

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• Exercise, spend time with family and friends, sleep and eat well.
• It’s OK to have hobbies. It’s OK to watch TV.
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- Take time off.

[Diagram showing pros and cons of working in academia]

PRO

YOU CAN WORK WHENEVER YOU WANT! EVERY DAY IS A SATURDAY!

CON

YOU WORK ON SATURDAYS.
Don’t Overwork.

Work is important but so is personal life.

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<td><strong>PRO</strong></td>
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<tr>
<td>You can work whenever you want. Every day is a Saturday!</td>
</tr>
<tr>
<td><strong>CON</strong></td>
</tr>
<tr>
<td>You work on Saturdays.</td>
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@gbg

Agreed:

- Your Weekly Dashboard
- 90h 41m
- Productivity and time spent on activities
  - Software Development
  - Communication & Scheduling
  - Entertainment
  - Uncategorised

@iliyast

Real progress in AI can only be achieved through a very intense work ethic.

12:40 PM · Feb 10, 2021

556 Retweets 170 Likes
Don’t Overwork.

Work is important but so is personal life.

• Set work time boundaries to exceed only on special occasions (e.g. deadlines).
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• It’s OK to have hobbies. It’s OK to watch TV.
• Take time off.

I used to be like him… until a summer internship that taught me better practices!
Stop saying “I didn’t get any work done today”

Email is work.
Meetings are work.
Teaching is work.
Writing is work.
Programming is work.
Presenting your paper is work.
Mentoring students is work.
... 
Looking for memes for your presentations is work.
Learn to Say No.
Learn to Say No.

• **Collaborations:** Do I want to work on this project? Does it fit with my research goals? Do I have time or am I already committed to too many projects?
Learn to Say No.

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- **Service**: give back to the community (reviewing, organizing workshop). Prioritize top conferences and workshops in your area. Don’t feel bad to decline if you’re overcommitted.
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**Helpful Phrases for Saying "No"**

- I can’t give you an answer right now, will you check back with me?
- I want to, but I’m unable to.
- I’m not able to commit to that right now.
- I really appreciate you asking me, but I can’t do it.
- I understand you really need my help, but I’m just not able to say yes to that. I’m so sorry.
- I’m going to say no for now. I’ll let you know if something changes.
- I’m honored that you would ask me, but my answer is no.”
- No, I can’t do that, but here’s what I can do …
- I just don’t have that to give right now.

---

*Image: A note on paper with helpful phrases for saying "no," including: I can’t give you an answer right now, will you check back with me? I want to, but I’m unable to. I’m not able to commit to that right now. I really appreciate you asking me, but I can’t do it. I understand you really need my help, but I’m just not able to say yes to that. I’m so sorry. I’m going to say no for now. I’ll let you know if something changes. I’m honored that you would ask me, but my answer is no.” No, I can’t do that, but here’s what I can do … I just don’t have that to give right now.*
Learn to Fail
Learn to Fail

• Don’t fall in love with your research project. Learn to recognize when an idea failed and move on.
Learn to Fail

- Don’t fall in love with your research project. Learn to recognize when an idea failed and move on.
- Don’t be defensive against criticism. Be thankful and take only what you want from it.
Learn to Fail

• Don’t fall in love with your research project. Learn to recognize when an idea failed and move on.

• Don’t be defensive against criticism. Be thankful and take only what you want from it.

• Get used to failing and recovering fast. Academia is full of rejections.
  • A handful of my failures :)
  • See how successful people fail all the time! https://veronikach.com/failure/how-i-fail-series/
Say “I don’t know” often
Say “I don’t know” often

• There’s no shame in admitting you don't know something.
Say “I don’t know” often

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• My pet peeve:

Asynchronous communication (i.e. emails) is heaven and hell for self-critical people, both for the same reason: you can write your message and delete and edit and correct and rephrase and revise and abbreviate and elaborate and rewrite it forever and send only when it’s perfect.
Turn your weaknesses to strengths

Mine:
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- Mediocre memory — be organized and document everything!
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Every time I forget something I knew, search for it and find something I wrote about it (lecture notes, Quora answer...), I feel a combination of pride and shame. But I think a more comforting way to look at it is that I store most of my knowledge on the cloud instead of locally.
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   Vered Shwartz
   @VeredShwartz

   4:32 PM · Jun 26, 2019 · Twitter Web Client
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• Not a genius — write a blog to explain concepts in simple terms to non experts.

  Probably Approximately a Scientific Blog

  Human-interpretable computer science and other ramblings

  Tuesday, January 12, 2021

  Commonsense Reasoning for Natural Language Processing
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• Take a break if you need it. Don't beat yourself up for delays in your research.
Acknowledging Privilege

And coincidences?
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• Luck
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  (most PhDs don't make a huge impact, and impact is temporary with the pace of research in NLP).
- Do work you will be proud of in a few years.
- Love what you do but have other things in life other than your research.
- Getting to where you are now already required talent. The rest depends on working well (find what works for you!), and a non-negligible amount of luck.
  **Good luck!**
Questions?

Thank You!

@VeredShwartz  vereds@allenai.org  Prospective students: https://www.cs.ubc.ca/students/grad/prospective