南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

STA-5007: Advanced Natural Language Processing

Lecture 1: Introduction

陈冠华 CHEN Guanhua

Department of Statistics and Data Science

Biography

南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

- Assistant professor in Stat-DS
  - Email: chengh3@sustech.edu.cn
  - Office: Business Building 319
- PhD from HKU, Bachelor & Master from Tsinghua
- Large language models and natural language processing
  - Data synthesis, reasoning LLMs
  - LLM-based agents, multimodal LLMs

Why faculty?

Why SUSTech?

Frontiers of LLMs and NLP

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- Better models in terms of efficacy, efficiency, safety, robustness
  - How to define ‘better’
- Extension to multimodalities like image, video, audio, time series, actions
- AI for science/engineering, AI + X


中华人民共和国中央人民政府
www.gov.cn

首页 | 简 |

首页 > 信息公开 > 国务院文件 > 科技、教育 > 科技

字号：默认 大 超大 | 打印 收藏 留言

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国务院关于深入实施“人工智能+”行动的意见

国发〔2025〕11号

各省、自治区、直辖市人民政府，国务院各部委、各直属机构：

国务院关于深入实施“人工智能+”行动的意见_科技_中国政府网

Course Information

- STA 5007: Advanced natural language processing
  - 3 credits, major elective course
  - Tuesday 3-4 (even week, L1-111) and Thursday 9-10 (every week, L3-206)
- Open office hour
  - Thursday 15:00-17:00, appoint or after class
- Teaching assistant:
  - 阮志文 Email: 12431111@mail.sustech.edu.cn
  - 李乙侠 Email: liyx2023@mail.sustech.edu.cn
  - 赖鹏 Email: 12432270@mail.sustech.edu.cn
  - 郑剑杰 Email：12432284@mail.sustech.edu.cn

Grading

- 5 minutes' sharing, 5%
- Quiz (5%)
- Homework, 40%
  - Four assignments x 10%
- Project, 25%
- Final exam, 25%

5 Minutes' Sharing

Everything related to NLP

- Interesting news, models, software
- Efficiency tools
- Views and insights
- Please add your references

- Start from week 3
- PPT should be sent to me by email before the class

References

- Weibo '爱可可爱生活', '宝玉xp'
- Wechat Subscription Account 'PaperWeekly' '深度学习自然语言处理', '机器之心', '量子位', '新智元', etc.
- 智源社区
- Hacker News

Reference Books

- Speech and Language Processing (3rd draft) [download]
- 《大语言模型》, 赵鑫等, 高等教育出版社，2024
- 《大规模语言模型-从理论到实践》，张奇等，电子工业出版社，2024

A good way to learn about state-of-the-art NLP concepts is through research papers and blog posts

Is it necessary to learn in the classroom?

Course Survey

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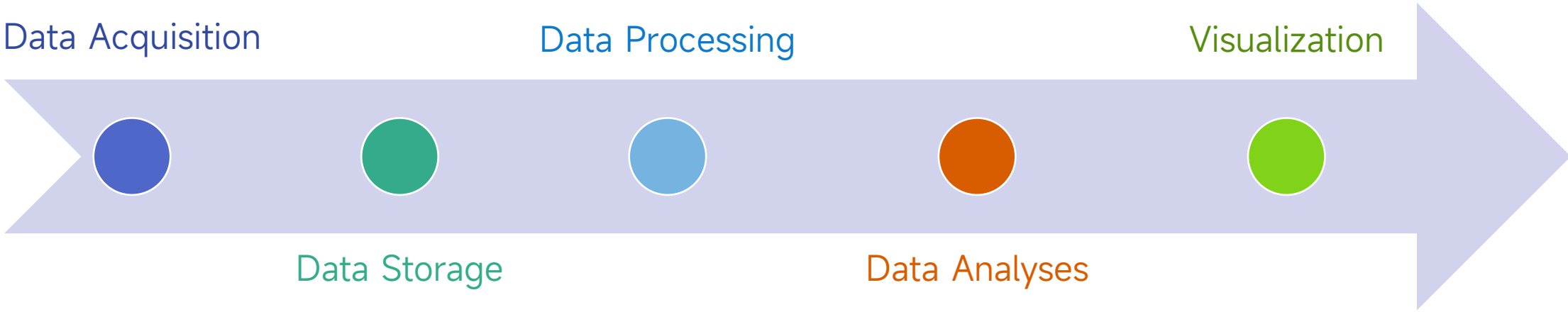
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

- Permanent link
  - https://www.wjx.cn/vm/m9KeRy0.aspx#
  - Anonymous
  - Please finish before 21:00, Sep 15
- Any suggestions, questions or problems

Course Goals

In Data Science, we focus on the following steps of data journey



★ Our focus in this course

Natural Language Processing

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- Natural language
  - English, Chinese, Spanish, Hindi, etc.
  - Spoken, written, sign language
  - Understanding cat/dog?
- Natural language processing
  - Building computer programs to analyze, understand and generate human language
  - Acquisition of these capabilities from knowledge and data
- An interdisciplinary field
  - Computer Science, Statistics
  - Linguistics, Psychology, Cognitive Science, etc.
  - NLP ≈ computational linguistics

Any exciting NLP applications?

Natural Language Processing

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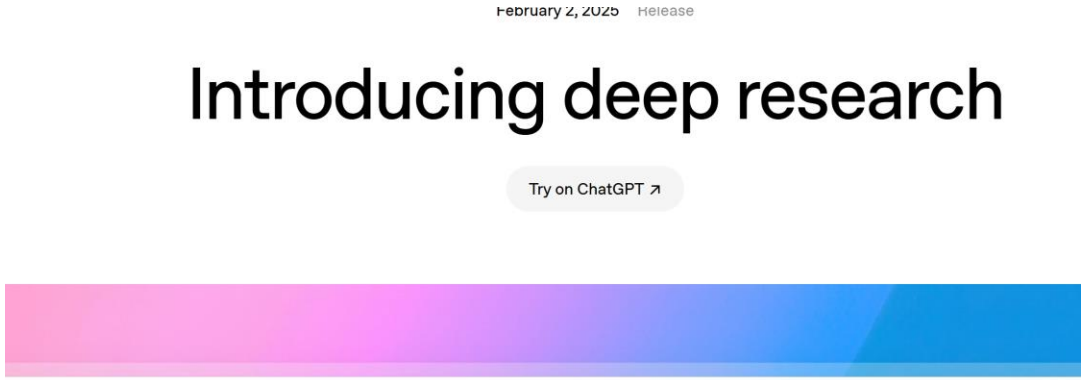
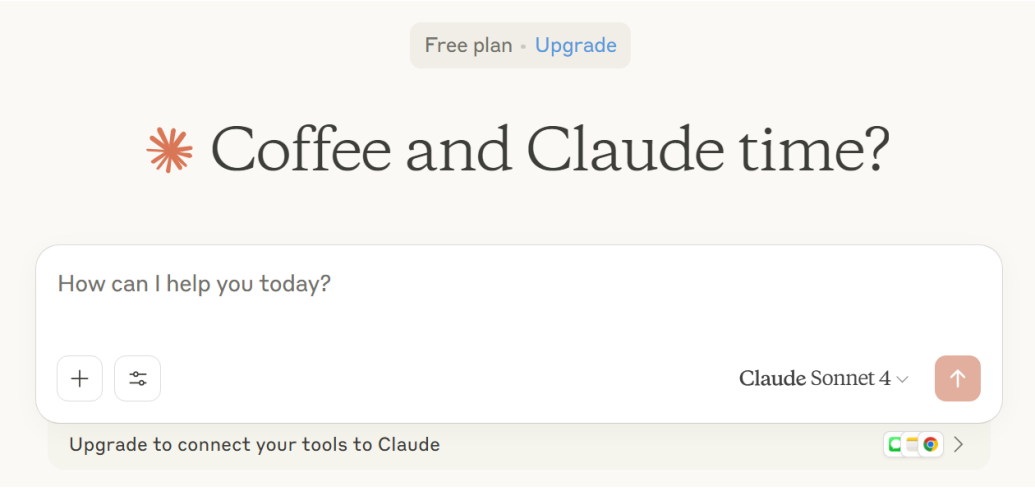
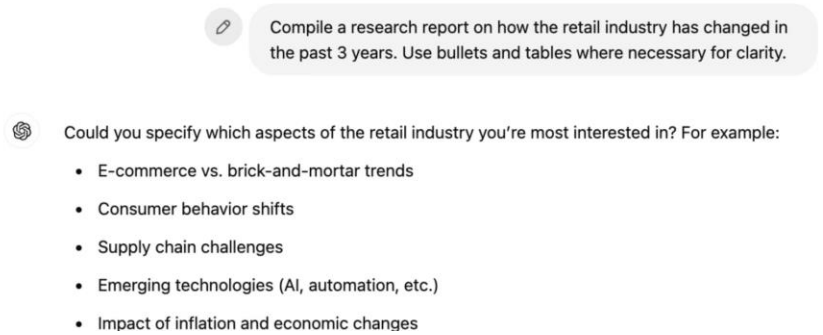
- Aid human-machine communication







Natural Language Processing

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- Aid human-human communication

Machine Translation

Emotional Agents

grammarly

Grammatical Error Correction

Speech-to-text

Natural Language Processing

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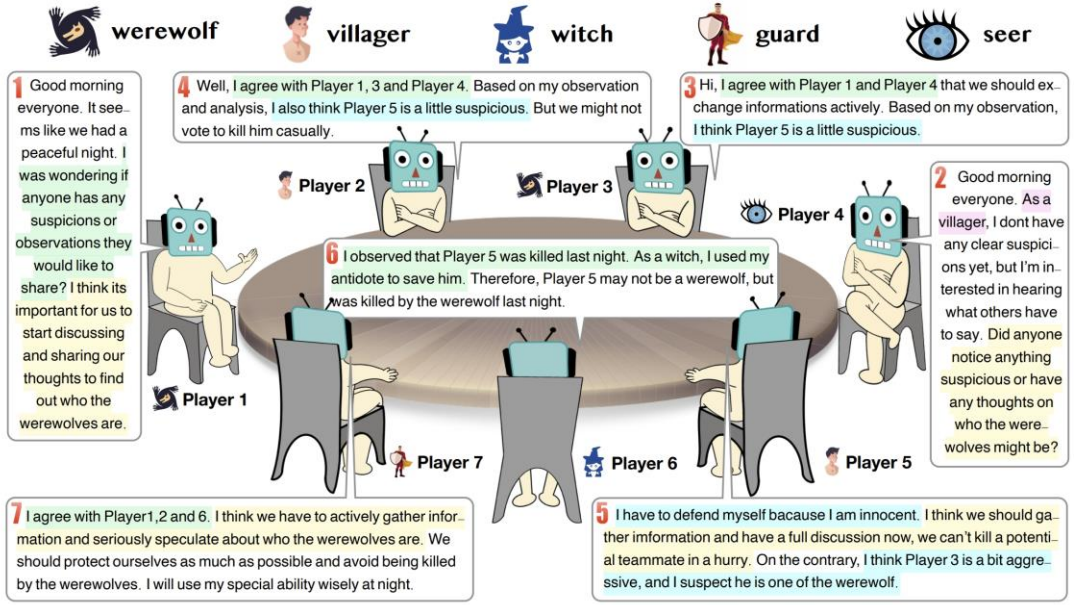
- Aid machine-machine communication?

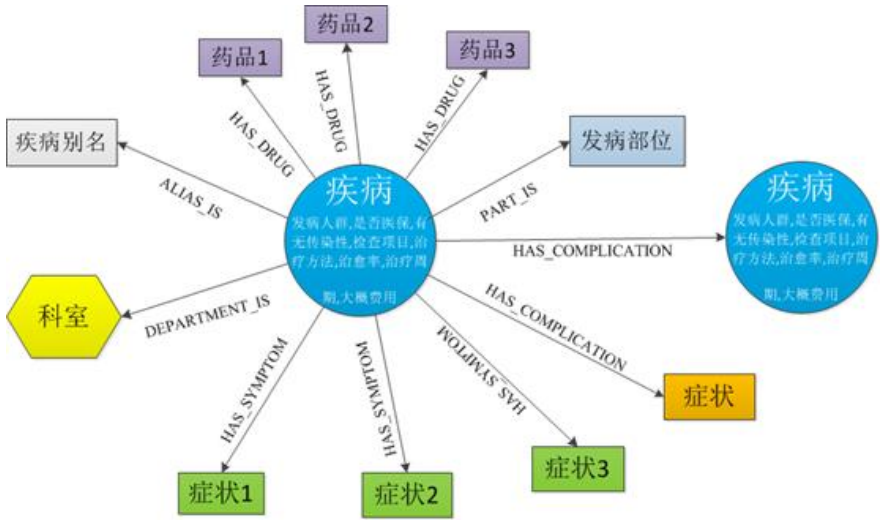
Stanford SmallVille

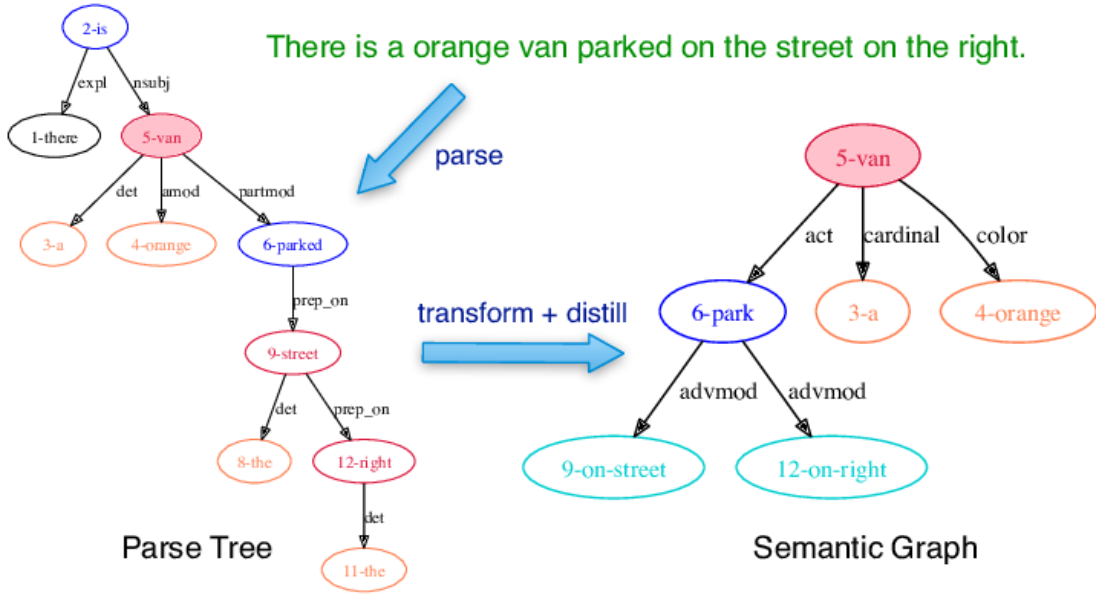
https://arxiv.org/abs/2304.03442



Natural Language Processing

- Analyze and understand languages
  - Semantic parsing
  - Text classification
  - Named entity recognition
  - Relation recognition





NLP Tasks

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Understanding	Generation	Analyses
Text classification	Machine translation	Part-of-speech tagging
Information extraction	Question answering	Dependency parsing
Named entity recognition	Text summarization	Constituency parsing
Relation recognition	Dialogue	Lexical normalization
Search engine	Data-to-Text Generation	Word sense disambiguation
Recommendation system	Grammatical error correction	.....
.....	.....	

NLP-progress

Application vs. Task ? Discriminative vs. generative ?

NLP Tasks

Pre-LLM era VS. LLM era

- Knowledge-intensive tasks
- Reasoning-intensive tasks

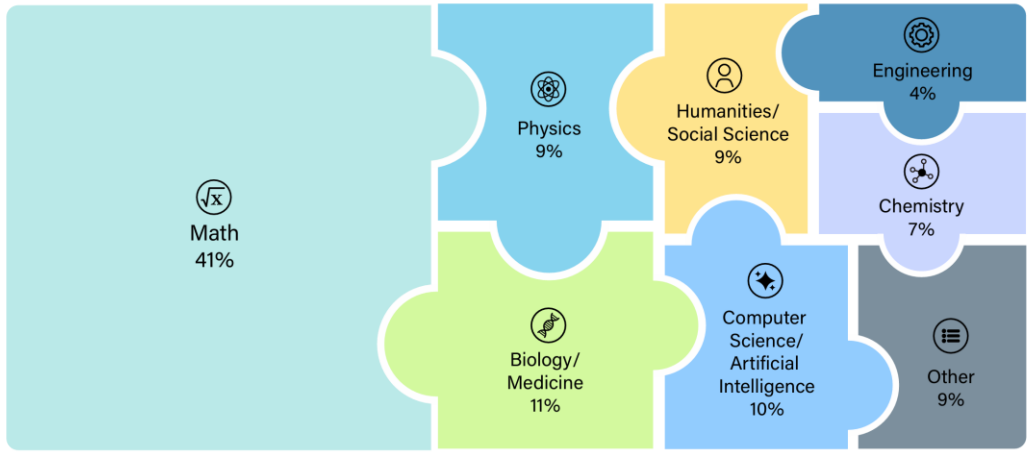
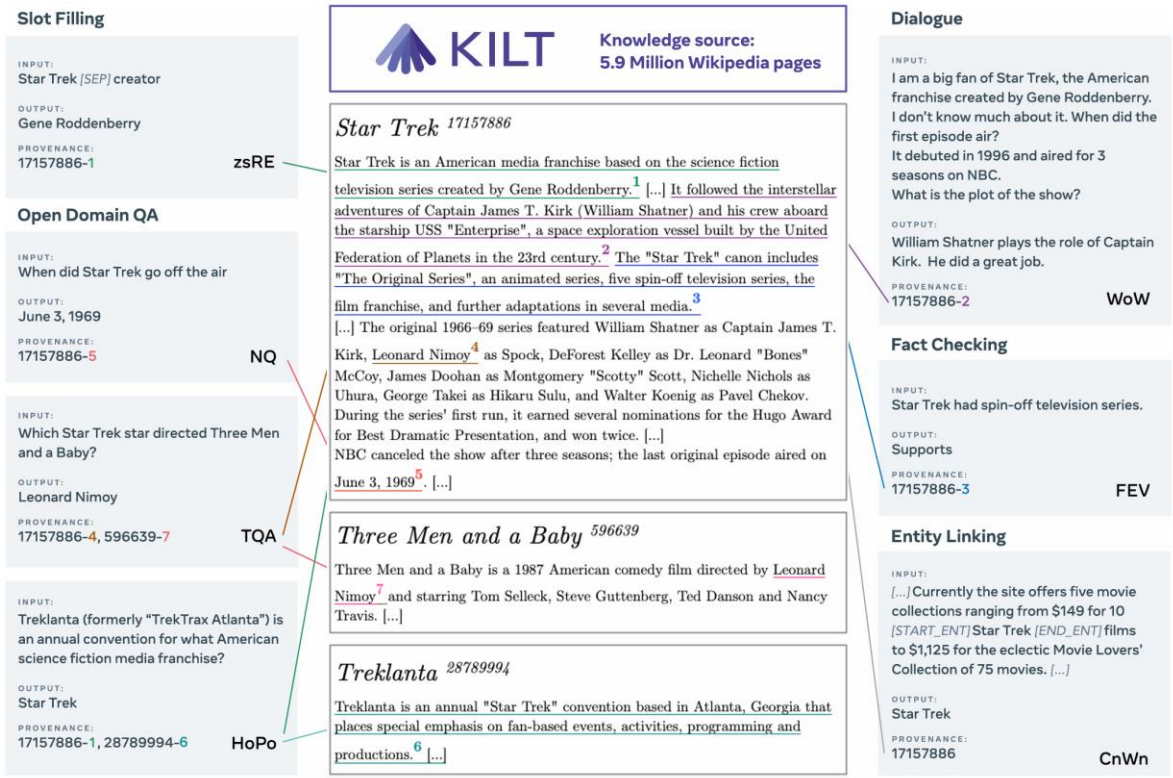


Figure 3: HLE consists of 2,500 exam questions in over a hundred subjects, grouped into high level

Humanity's Last Exam



KILT: a Benchmark for Knowledge Intensive Language Tasks - ACL Anthology

Syllabus

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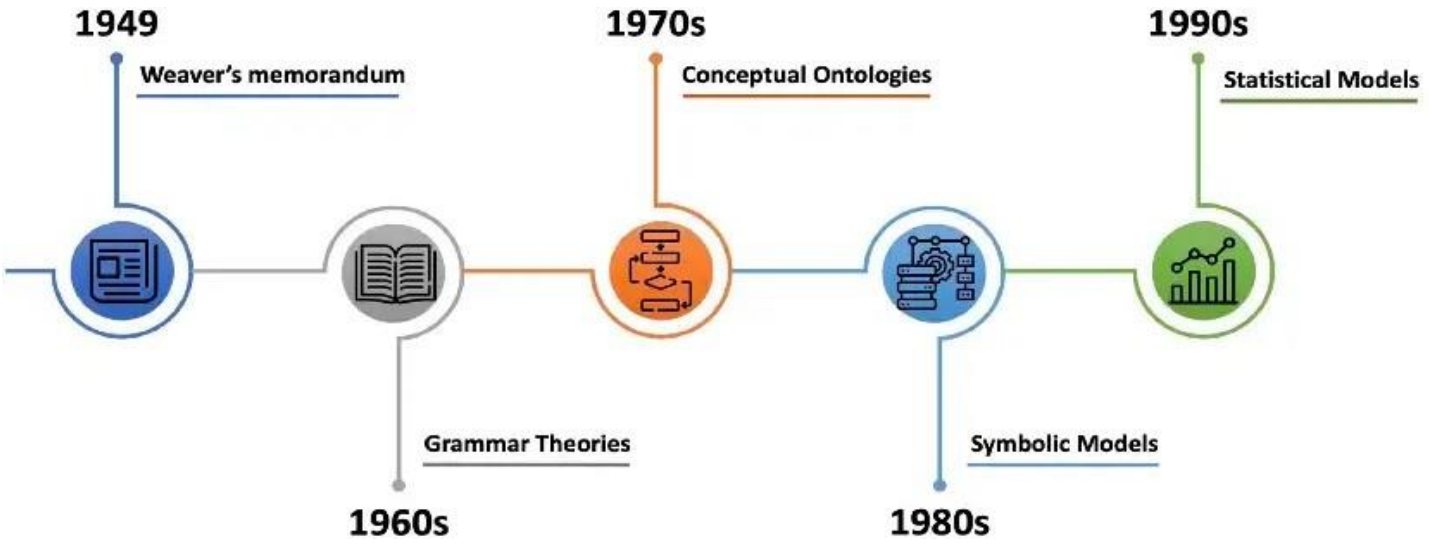
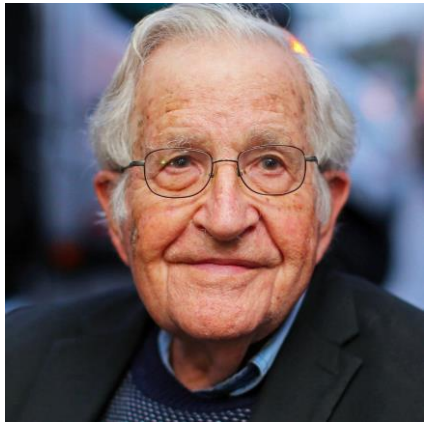
Week	Date	Name	Lecture	HomeWork	Week	Date	Name	Lecture	HomeWork
1	9.11	Lecture 1	Introduction to NLP		9	11.6	Lecture 13	RAG	Quiz
2	9.16	Lecture 2	Deep learning basics		10	11.11	Lecture 14	LLM Evaluation	
2	9.18	Lecture 3	Language Model		10	11.13	Lecture 15	Efficient LLM Inference	
3	9.25	Lecture 4	Transformer model (1)	HW1 release	11	11.20	Lecture 16	LLM agent (1)	
4	9.30	Lecture 5	Transformer model (2)		12	11.25	Lecture 17	LLM agent (2)	HW4 release
4	10.2	Lecture 6	Skip due to holiday		12	11.27	Lecture 18	Scaling Law	
5	10.9	Lecture 7	Pretrained language model		13	12.4	Lecture 19	Reasoning LLMs	
6	10.14	Lecture 8	Learn to do research	HW2 release	14	12.9	Lecture 20	Multimodal AI	
6	10.16	Lecture 9	Introduction to LLM		14	12.11	Lecture 21	Guest talk (2)	
7	10.23	Lecture 10	LLM coding example	Project release	15	12.18	Lecture 22	NLP Future Trend	
8	10.28	Lecture 11	Guest talk (1)		16	12.23	Lecture 23	Presentation for project	
8	10.30	Lecture 12	LLM Data Synthesis	HW3 release	16	12.25	Lecture 24	Presentation for project	

A Brief History of NLP





Avram Noam Chomsky

https://medium.com/@antoine.louis/a-brief-history-of-natural-language-processing-part-1-ffbcb937ebce

知乎：如何系统地学习乔姆斯基的语言学理论？

A Brief History of NLP

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Natural language VS. Formal language

- Natural Language evolves naturally through use and repetition by humans for communication.
- Formal Language is designed by humans for specific, precise applications, such as programming language, mathematical notation, musical notations

```
import data.rat.basic
       data.nat.parity
       tactic

lemma even_if_square_even {n : ℕ} (hn2 : 2 ∣ (n*n)) : 2 ∣ n :=
begin
  by_contra hc,
  have hmod2 : n % 2 = 1, from nat.not_even_iff.mp hc,
  set k := n / 2 with hk,
  have hn : n = 1 + 2*k,
  { rw [←nat.mod_add_div n 2, hmod2] },
  have hnn : n*n = 1 + 2*(2*k + 2*k*k),
  { rw hn, ring },
  rw [nat.dvd_iff_mod_eq_zero, hnn] at hn2,
  norm_num at hn2,
end
```

Mathematics in Lean — Mathematics in Lean v4.19.0 documentation

Formal Language

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Seed Prover IMO 2025

Seed Prover solved 4 out of 6 problems in IMO 2025 durint the context, with the following breakdown:

- **Day 1**: Fully solved P2 (geometry) and P3 (number theory), fully solved P1 (combinatorics) after the compe
- **Day 2**: Fully solved P4 (number theory) and P5 (combinatorics / algebra)

Details

- P1 (combinatorics) Lean : Fully proved after the competition, this is not scored by the IMO.
- P2 (geometry) NL : Generated and verified in 2 seconds using Seed-Geometry system
- P3 (number theory) NL Lean: Solved in 3 days, with a 2000-line formal proof
- P4 (number theory) NL Lean: Solved in 3 days, with a 4000-line formal proof
- P5 (combinatorics / algebra) NL Lean: Solved in 1 day, with a proof slightly different from known human solutions

P1,3,4,5 are compiled under Lean v4.14.0.

ByteDance-Seed/Seed-Prover

Context-Free Grammar

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- A set of formal rules used to describe the structure of strings in a formal language
  - Any non-terminal symbol (a placeholder for a syntactic structure) can be replaced (or "expanded") using a grammar rule regardless of the symbols surrounding it.

- **Non-terminals (N):** `{<S>, <NP>, <VP>, <N>, <V>, <Det>}`
- **Terminals (Σ):** `{the, a, cat, dog, man, loves, feeds, sees}`
- **Start Symbol (S):** `<S>`
- **Production Rules (P):**
  1. `<S> -> <NP> <VP>` // A sentence is a Noun Phrase followed by a Verb Phrase.
  2. `<NP> -> <Det> <N>` // A Noun Phrase is a Determiner followed by a Noun.
  3. `<VP> -> <V> <NP>` // A Verb Phrase is a Verb followed by a Noun Phrase.
  4. `<Det> -> the | a` // A Determiner is "the" or "a".
  5. `<N> -> cat | dog | man` // A Noun is "cat", "dog", or "man".
  6. `<V> -> loves | feeds | sees` // A Verb is "loves", "feeds", or "sees".

1. `<S>`
2. `<NP> <VP>` (Rule 1)
3. `<Det> <N> <VP>` (Rule 2)
4. `the <N> <VP>` (Rule 4: chose `the`)
5. `the cat <VP>` (Rule 5: chose `cat`)
6. `the cat <V> <NP>` (Rule 3)
7. `the cat sees <NP>` (Rule 6: chose `sees`)
8. `the cat sees <Det> <N>` (Rule 2)
9. `the cat sees a <N>` (Rule 4: chose `a`)
10. `the cat sees a man` (Rule 5: chose `man`)

Context-Free Grammar

【西湖大学 张岳老师 | 自然语言处理在线课程 第十章 - 2节】概率上下文无关文法（Probabilistic context free grammar）

2444 1 2022-04-25 13:17:55 未经作者授权，禁止转载

Probabilistic Context Free Grammar

WestlakeNLP

- Context Free Grammars (CFG)

  Formally, a CFG is a 4-tuple: <N,Σ,R,S>.

  - N: the set of non-terminals (i.e. A,B,C,…)
  - Σ: the set of terminals (i.e. $\alpha,\beta,\gamma,\ldots$)
  - R: the set of production rules (i.e. A->BC, A->γ,…)
  - S: the start symbol

https://www.bilibili.com/video/BV1gv411g735/

Lectures - Natural Language Processing - A Machine Learning Perspective / Spring 2023

Statistical Learning

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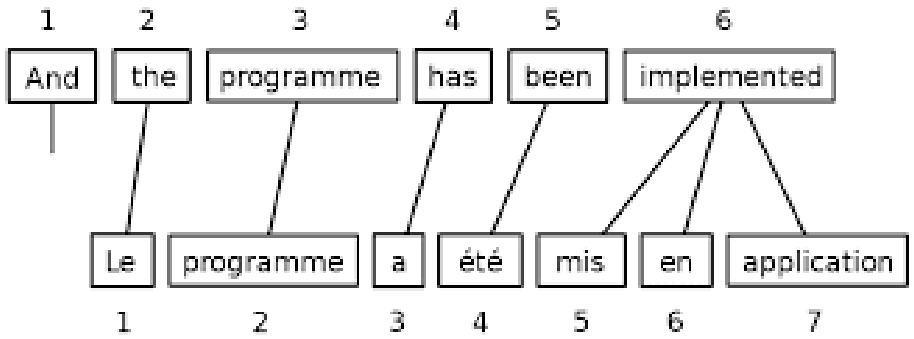
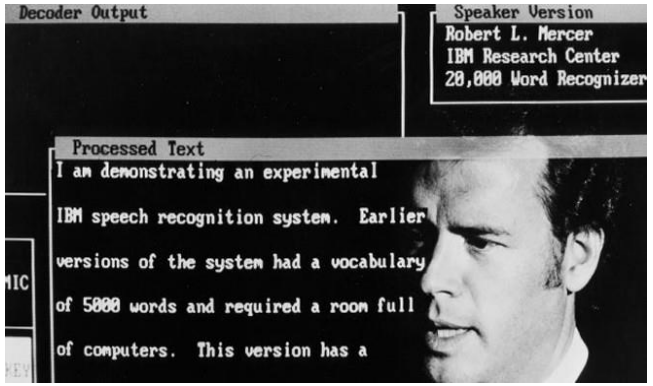
IBM translation model



Expectation-maximization (EM) algorithm

Speech recognition

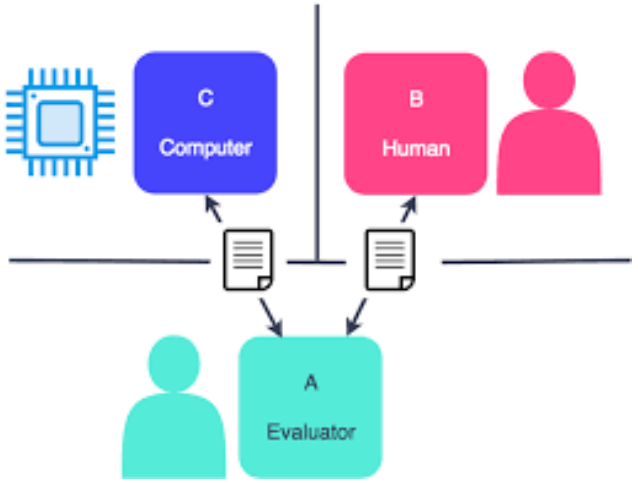


Hidden Markov Model (HMM) algorithm

Anytime a linguist leaves the group the (speech) recognition rate goes up
- Fred Jelinek 1998

Turing Test

- Ability to understand and generate language → intelligence

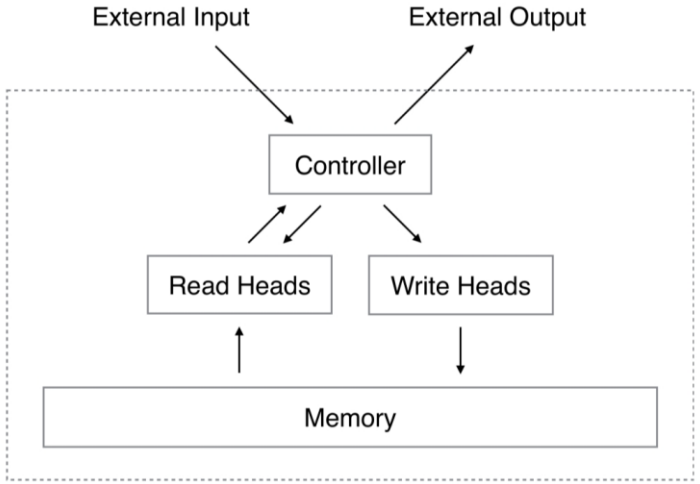


A. M. Turing (1950) Computing Machinery and Intelligence. *Mind 49:* 433-460.

COMPUTING MACHINERY AND INTELLIGENCE

By A. M. Turing

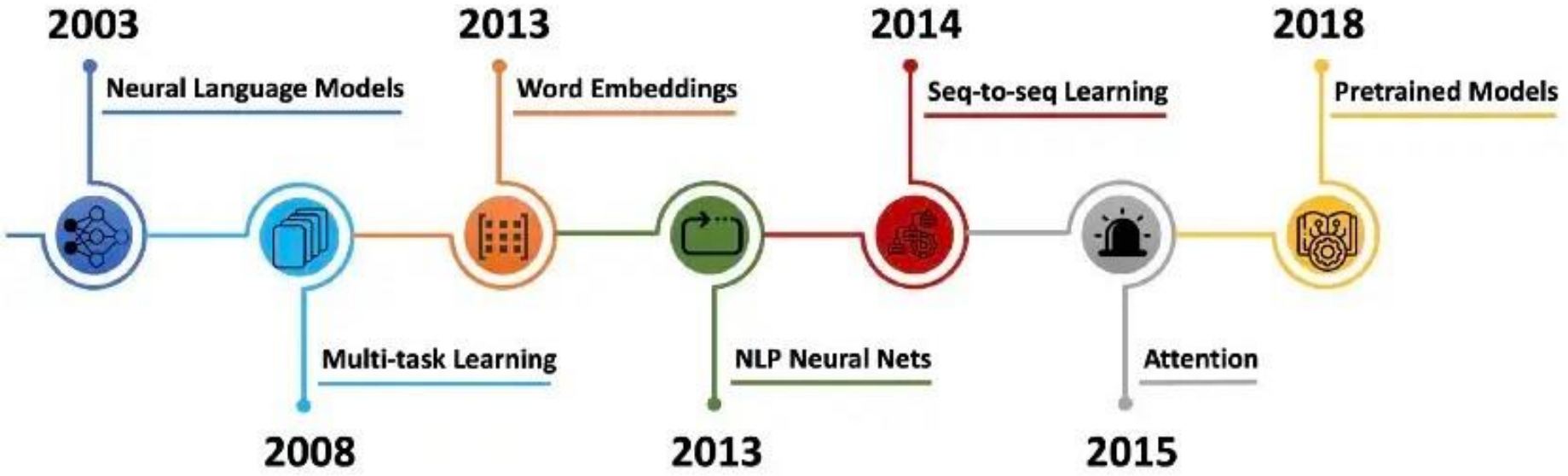
1. The Imitation Game



(Neural) Turing Machine

A Brief History of NLP

Yoshua Bengio



2018: BERT 2019: T5, RoBERTa 2020: GPT-3 2022: ChatGPT

知乎：Yoshua Bengio为什么能跟Hinton、LeCun相提并论

https://medium.com/@antoine.louis/a-brief-history-of-natural-language-processing-part-2-f5e575e8e37

Symbolic and Probabilistic NLP

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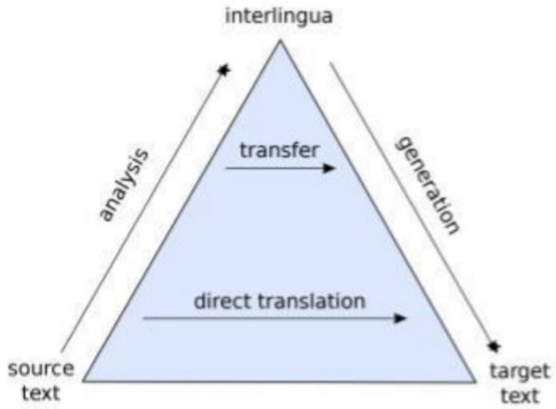
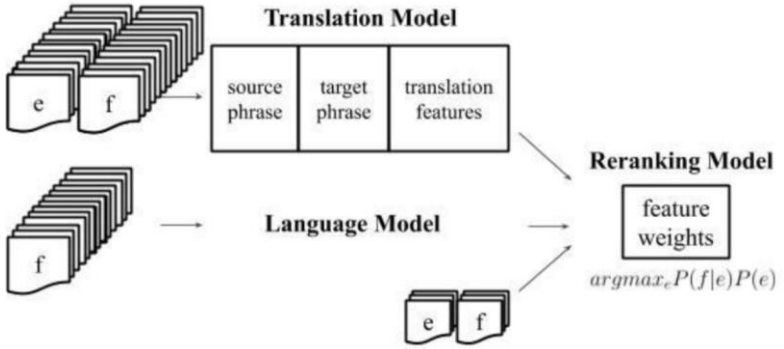
Logic-based/Rule-based NLP



~1990s

Statistical NLP



Probabilistic and Connectionist NLP

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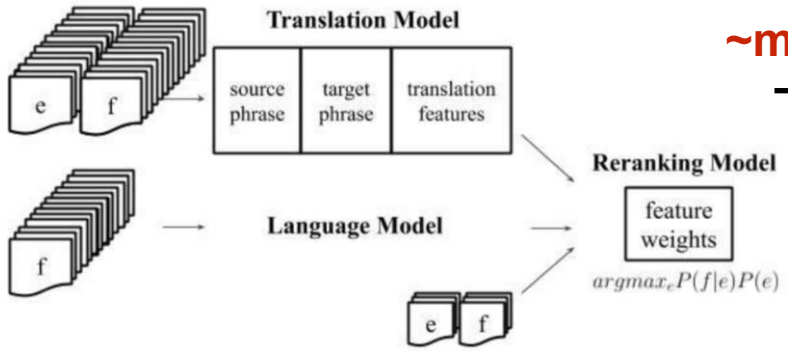
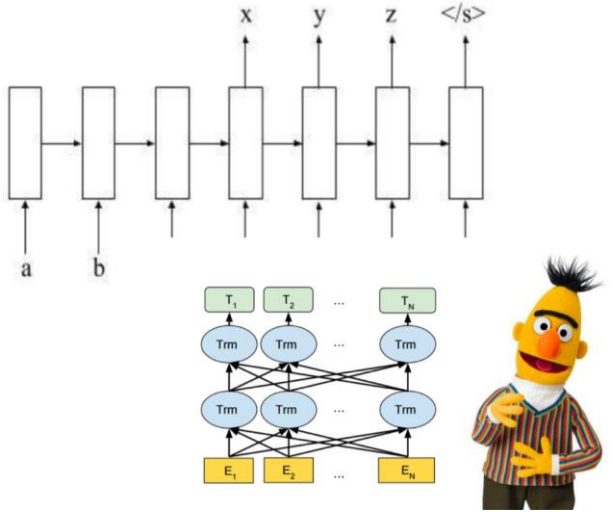
Engineered Features/Representations



~mid 2010s

Learned Features/Representations



The Era of Deep Learning

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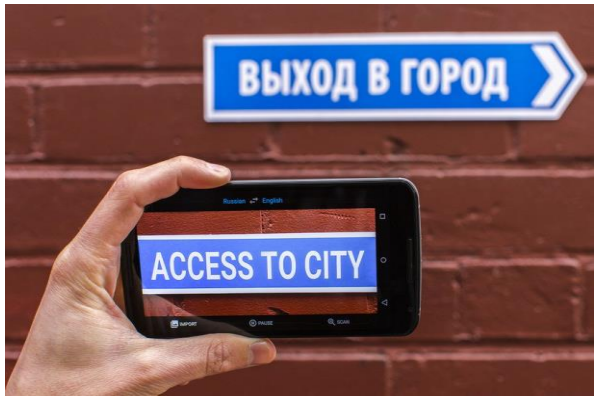
- Significant advances in core NLP technologies
- Essential ingredient
  - Large-scale supervision
  - Lots of compute
- Reduced manual effort - less/zero feature engineering

GPU

TPU



36M sentence pairs

Russian: Машинный перевод - это круто!

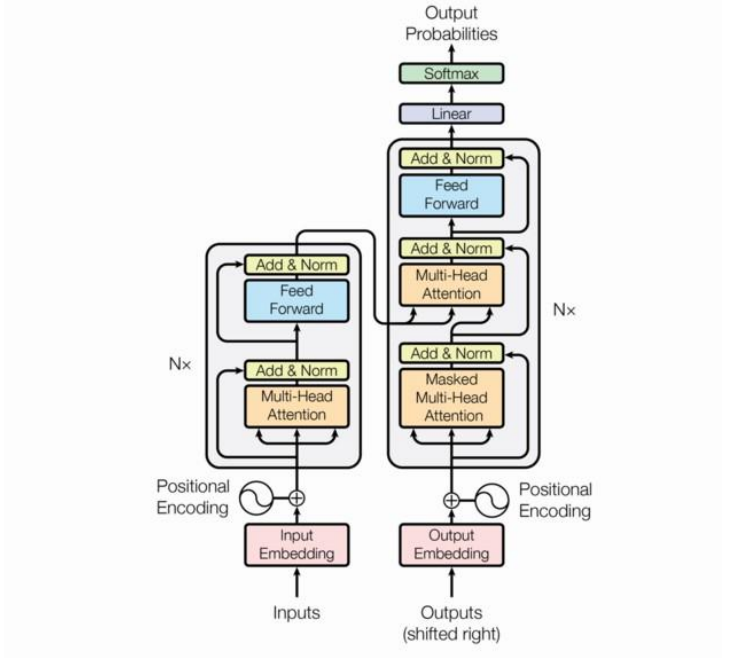
English: Machine translation is cool!

Pipeline VS. End-to-end

The nine steps are

1. Prepare data (45 minutes)
2. Run GIZA++ (16 hours)
3. Align words (2:30 hours)
4. Get lexical translation table (30 minutes)
5. Extract phrases (10 minutes)
6. Score phrases (1:15 hours)
7. Build lexicalized reordering model (1 hour)
8. Build generation models
9. Create configuration file (1 second)

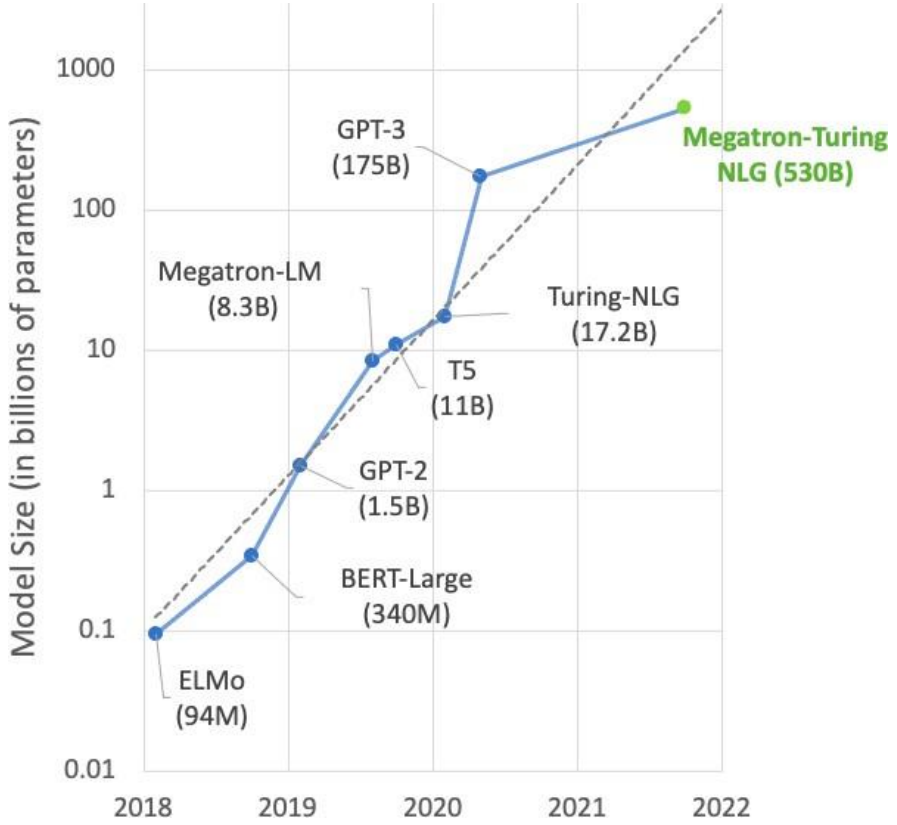
Pipeline method with SMT



End-to-end method with NMT

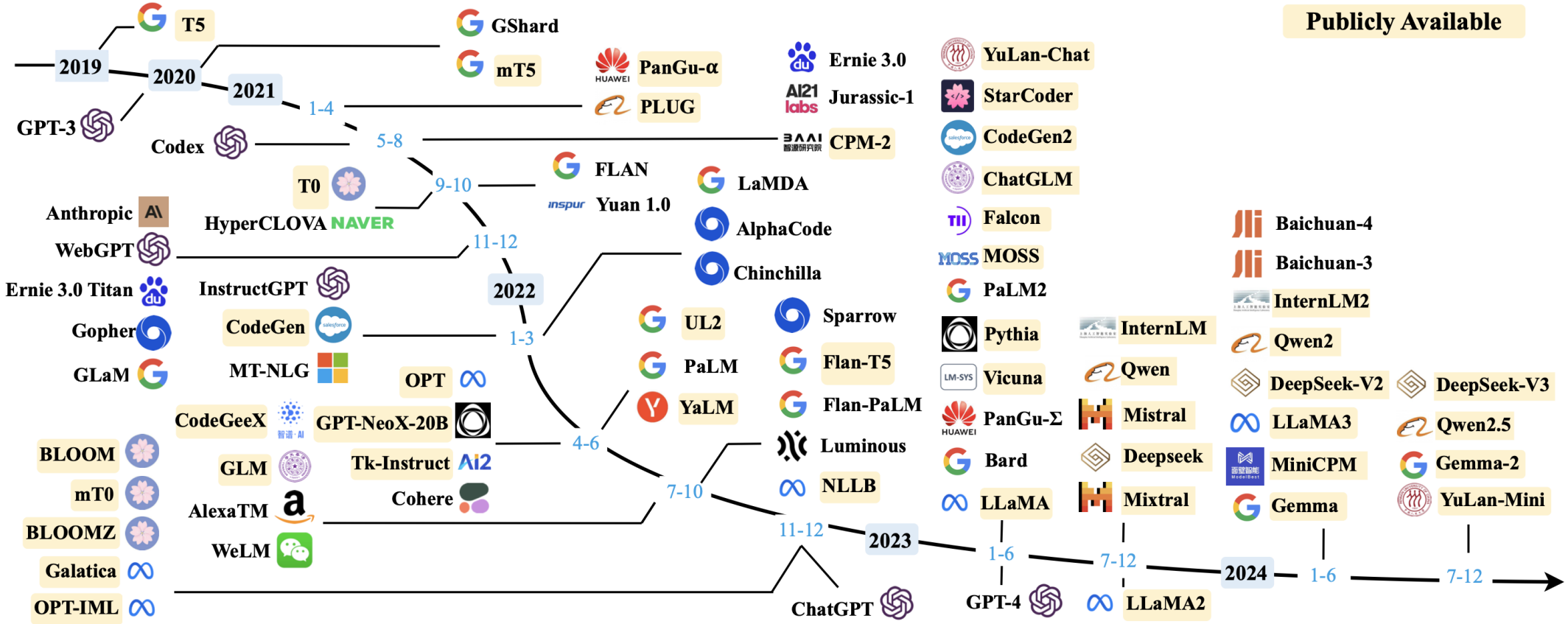
The Era of Pre-training / LLMs

BERT, ELMo, ERNIE…



- Leverages a lot of unlabeled text
- Model size increased by 1000+

The Era of Pre-training / LLMs



A Brief History of NLP

Discussion:

What are you most excited about NLP?

Why is NLP so Difficult

- ##自然语言处理太难了##

分享一件有趣的事，一位北京大哥点了油渣儿菜，上菜后抱怨这菜怎么是苦的，原来他不知道儿菜是一种味道略苦的蔬菜，误以为是油渣儿，菜！
感叹南北文化、饮食差异甚是有趣 @安宁庄前街的英文是啥

原文：Your state or province
机器翻译：贵州省
原文：PEARL Harbor
翻译：蚌埠

Why is NLP so Difficult

- ##自然语言处理太难了##

Why is NLP so Difficult

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Ambiguous	Dialects, accents	Abbreviation
Expressivity	Listener has to infer - pragmatics	Humor or irony

Unmodeled Variables

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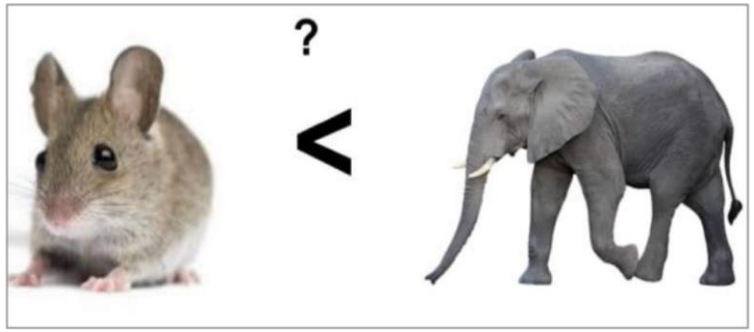
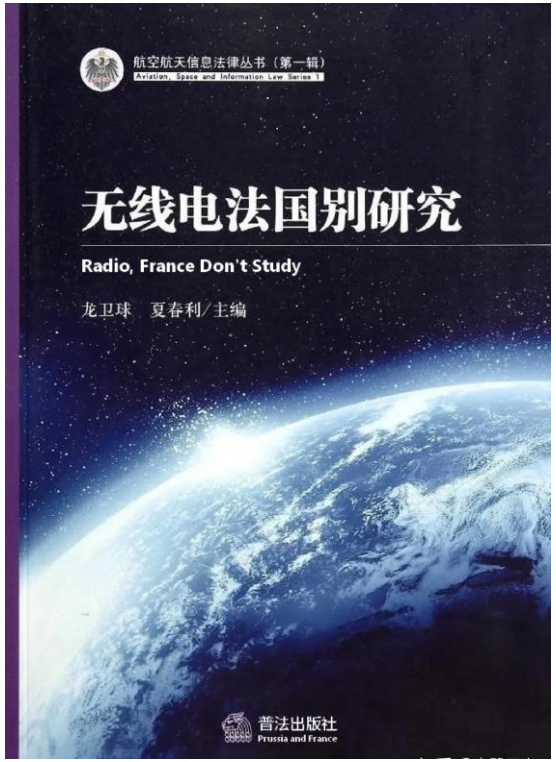
- World knowledge
  - I dropped the glass on the floor and it broke
  - I dropped the hammer on the glass and it broke



Challenges of Words

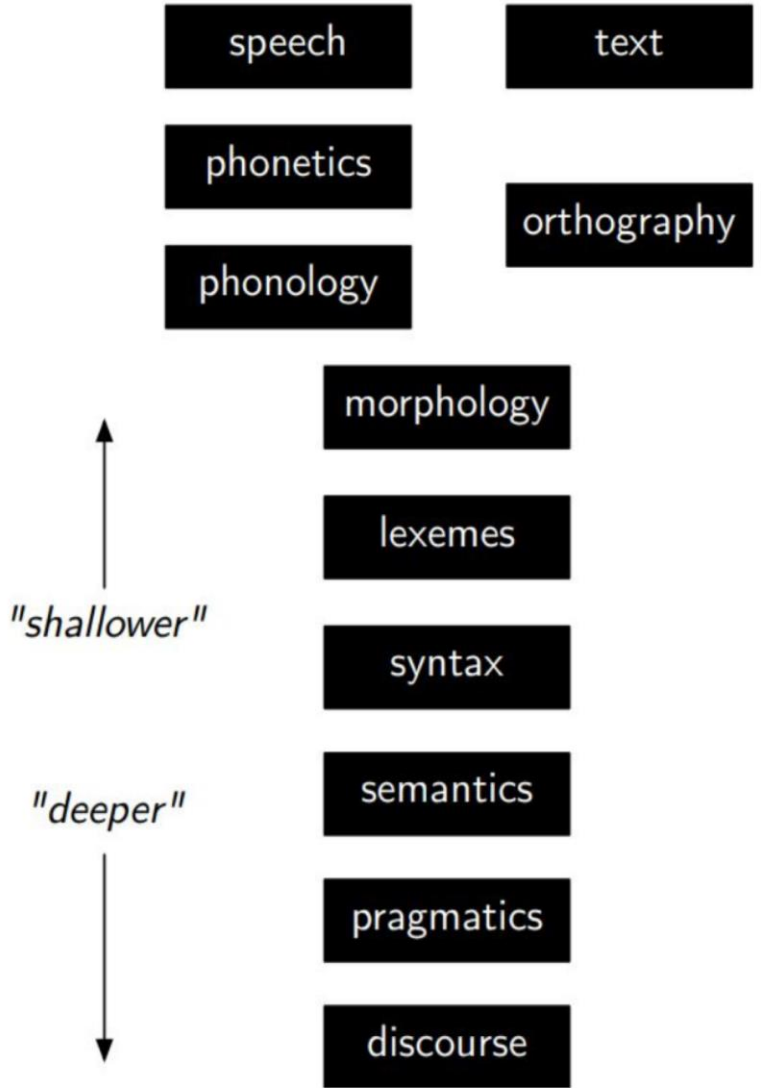
- Segmenting text into words
  - E.g., Chinese example，无线电/法国/别研究 or 无线电法/国别研究
- Morphological variation
  - E.g., un-finish-ed, scient-ist
- Multiword expressions
  - E.g., take out, make up
- New words and changing meanings
  - E.g., covid
  - E.g., Bachelor: a young knight -> an academic degree



Levels of Linguistic Knowledge

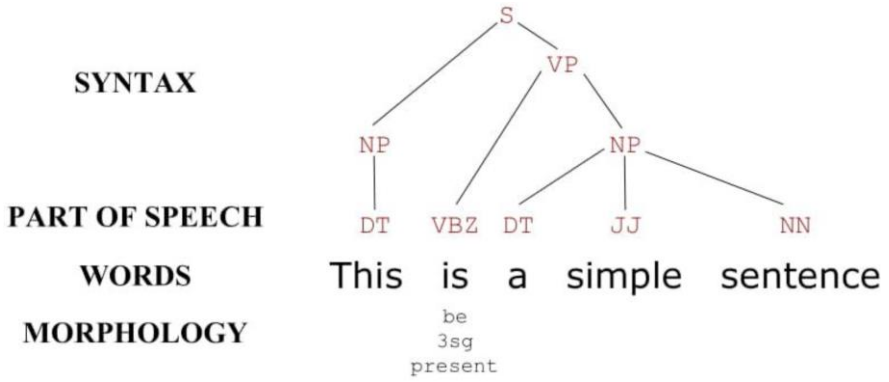
- What dose an NLP system need to know a language?
- Phonetics (语音学)
  - Study how humans produce and perceive sounds
- Morphology (词形学)
  - Study how words are formed: such as stems, root words, prefixes, suffixes
- Part-of-Speech (词性)
  - Predict which category a word is assigned to in accordance with its syntactic functions

PART OF SPEECH	DT	VBZ	DT	JJ	NN
WORDS	This	is	a	simple	sentence
MORPHOLOGY		be 3sg present			

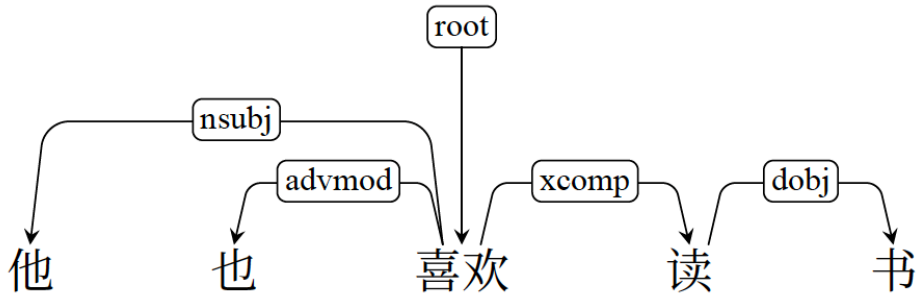


Levels of Linguistic Knowledge

- Syntax (句法)
  - Study how words and morphemes combine to form larger units such as phrases and sentences
  - Constituency parsing (成分分析)
  - Dependency parsing (依存分析)



Constituency parsing tree



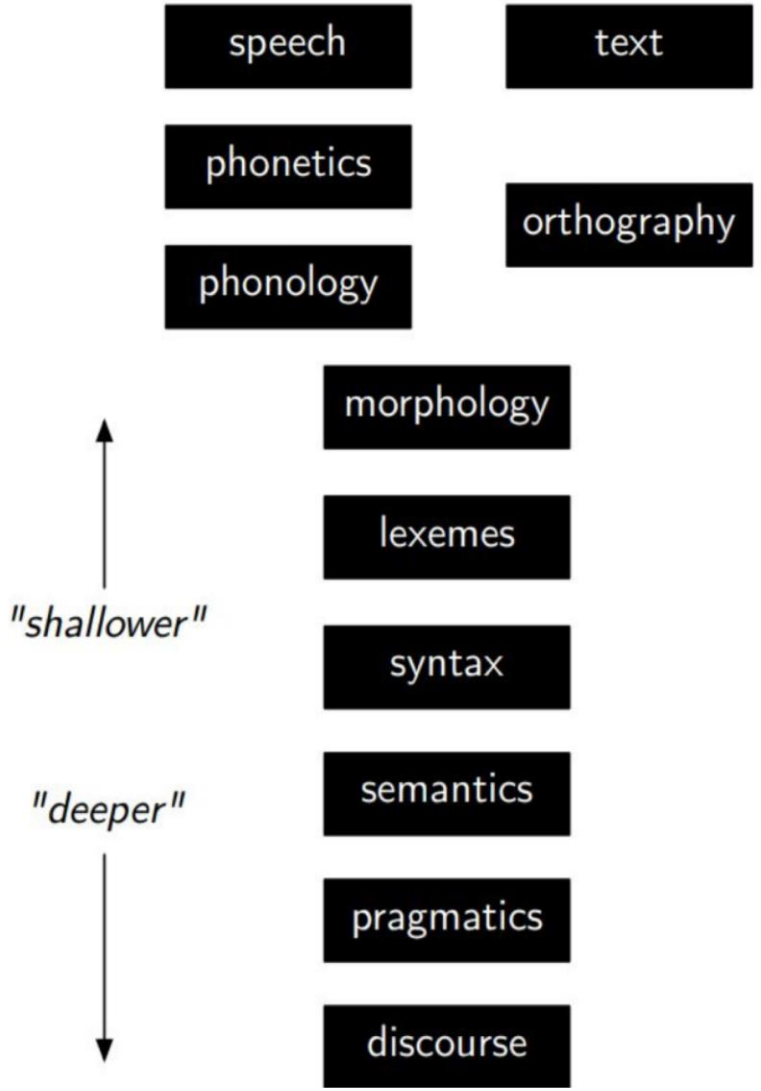
Dependency parsing tree

Constituency/Dependency Parsing with Stanza toolkit

Levels of Linguistic Knowledge

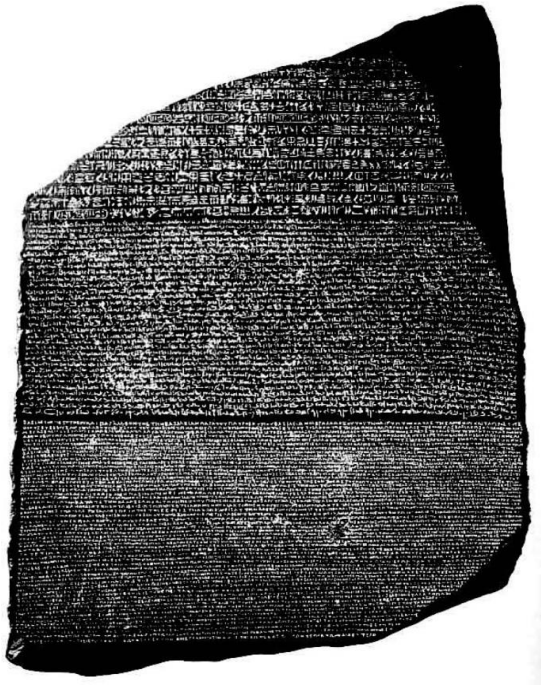
- Semantics (语义)
  - Study meaning of words, phrases, sentences, or discourse
  - Lexical relation
    - Synonymy(同义)/antonymy(反义)
    - Hypernymy(上位词)/hyponymy(下位词)
  - Named entity recognition
  - Word sense disambiguation
- Pragmatics (语用学)
  - Study how context contributes to meaning
  - Implicature (言外之意)

When Sebastian Thrun PERSON started working on self-driving cars at Google ORG in 2007 DATE, few people outside of the company took him seriously.



Corpora

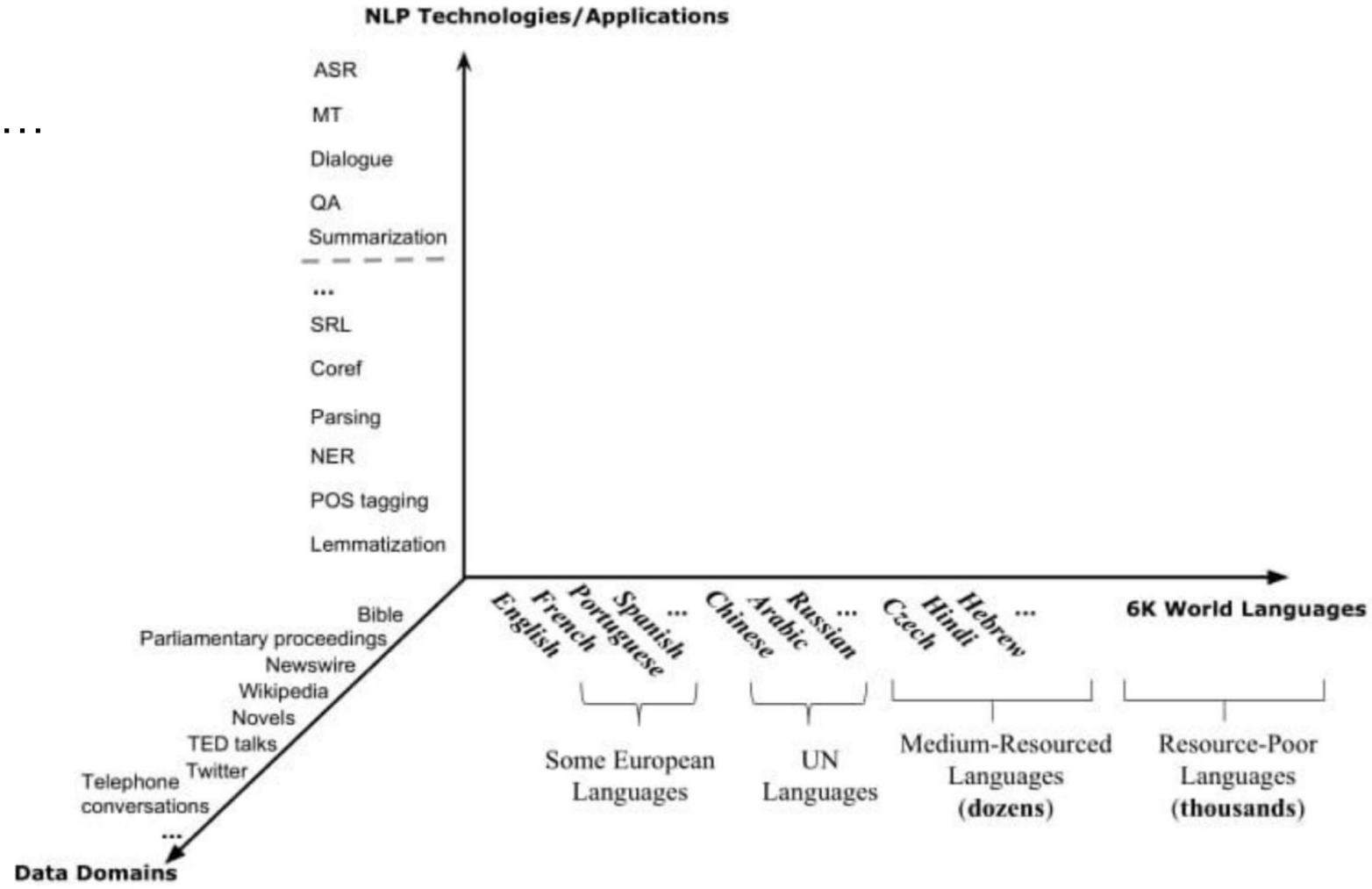
- A corpus is a collection of text
  - Often annotated in some way
  - Sometimes just lots of text
- Examples
  - Penn Treebank: 1M words of parsed WSJ
  - Canadian Hansards: 10M+ words of aligned French/English sentences
  - Web: billions of words
  - Amazon reviews



Rosetta Stone

Data Domains

- Diverse domains
- Language, task, source, style, …



陆奇：我的大模型世界观

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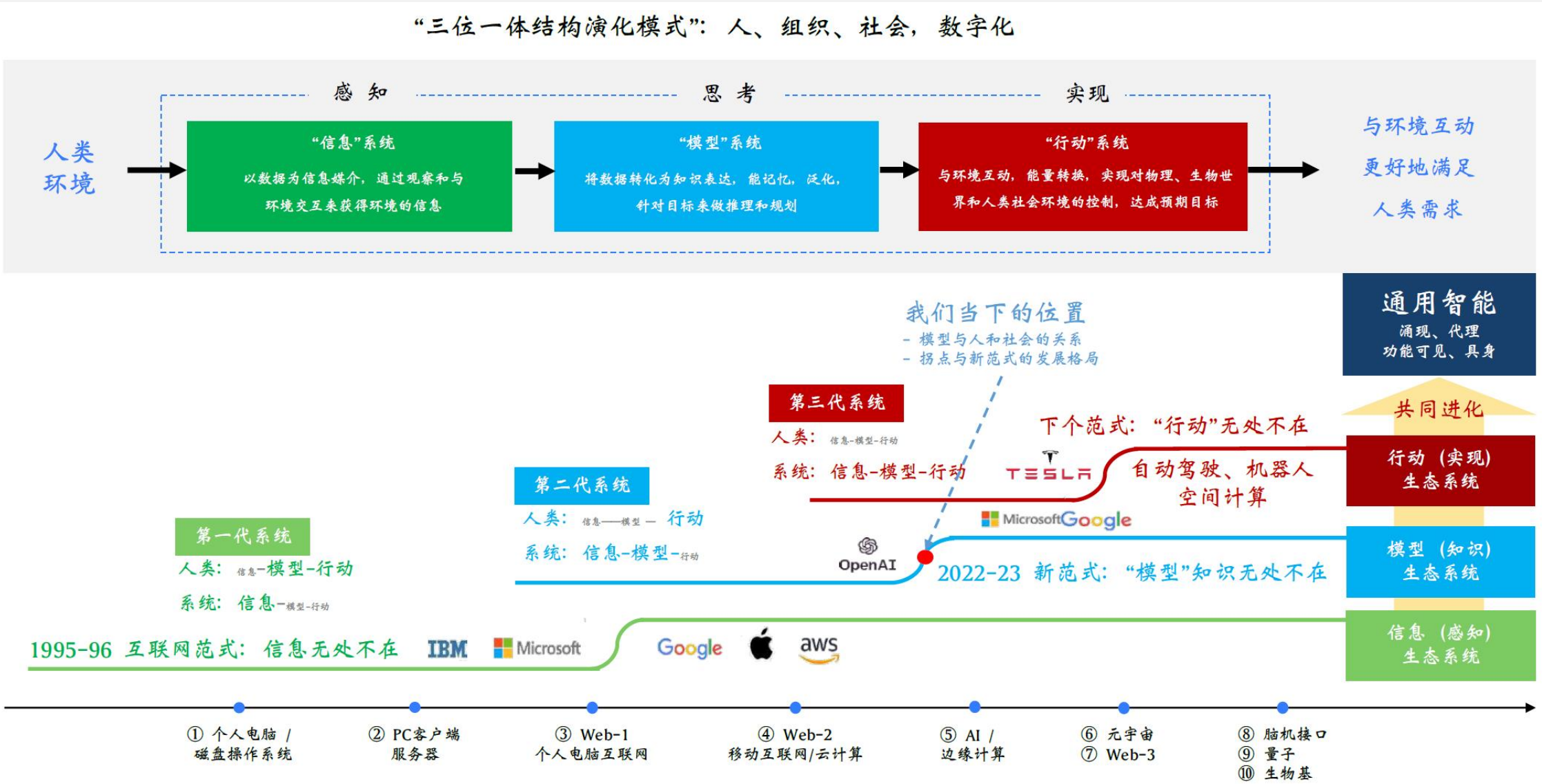
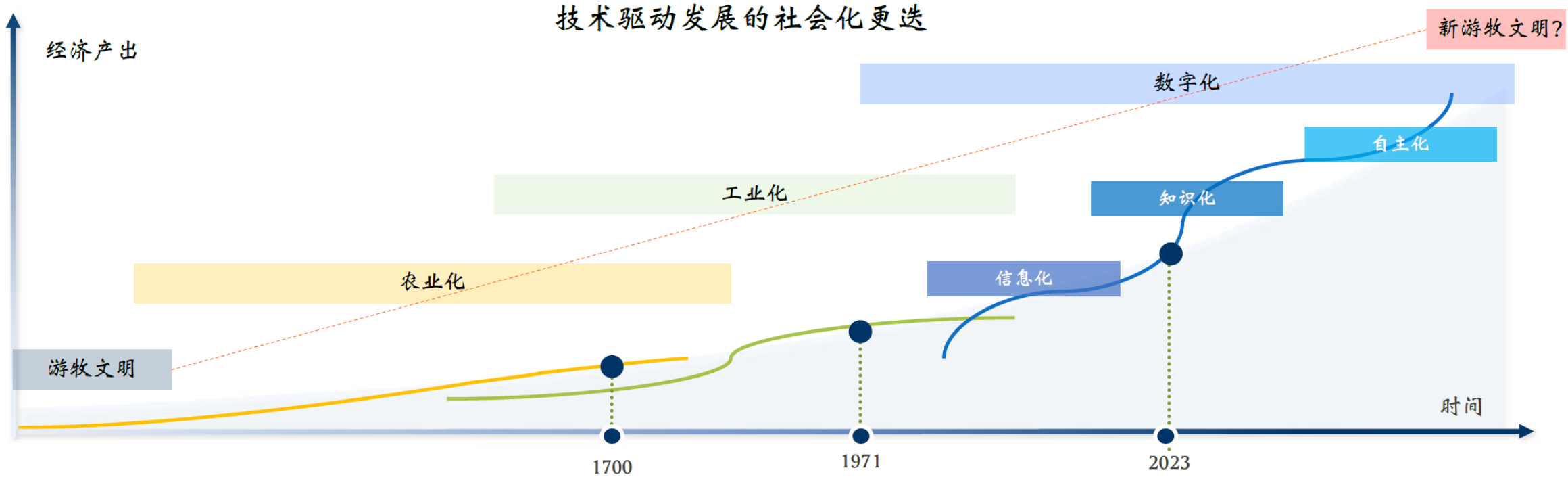
- 任何复杂体系，包括一个人、一家公司、一个社会，甚至数字化本身的数字化体系，包括：
  - 信息系统，从环境当中获得信息；
  - 模型系统，对信息做一种表达，进行推理和规划；
  - 行动系统，我们最终和环境做交互，达到人类想达到的目的；
- 我们每个人都是模型的组合。人有三种模型：
  - 认知模型，我们能看、能听、能思考、能规划；
  - 任务模型，我们能爬楼梯、搬椅子剥鸡蛋；
  - 领域模型，我们有些人是医生，有些人是律师，有些人是码农。
- “这一次大模型拐点会让所有服务经济中的人、蓝领基本都受影响，因为他们是模型，除非有独到见解，否则你今天所从事的服务大模型都有。”
- 更多阅读：《陆奇：我的大模型世界观》

新范式的新拐点


“三位一体结构演化模式”：人、组织、社会，数字化
感 知
思 考
实现
人类
环境
“信息”系统
以数据为信息媒介，通过观察和与环境交互来获得环境的信息
“模型”系统
将数据转化为知识表达，能记忆，泛化，针对目标来做推理和规划
“行动”系统
与环境互动，能量转换，实现对物理、生物世界和人类社会环境的控制，达成预期目标
与环境互动
更好地满足
人类需求
我们当下的位置
- 模型与人和社会的关系
- 拐点与新范式的发展格局
通用智能
涌现、代理
功能可见、具身
共同进化
第三代系统
人类：信息-模型-行动
系统：信息-模型-行动
下个范式：“行动”无处不在
TESLA
自动驾驶、机器人
空间计算
行动（实现）
生态系统
第二代系统
人类：信息——模型 — 行动
系统：信息-模型-行动
Microsoft Google
OpenAI
2022-23 新范式：“模型”知识无处不在
模型（知识）
生态系统
第一代系统
人类：信息-模型-行动
系统：信息-模型-行动
1995-96 互联网范式：信息无处不在
IBM
Microsoft
Google
aws
信息（感知）
生态系统
① 个人电脑 / 磁盘操作系统
② PC客户端 服务器
③ Web-1 个人电脑互联网
④ Web-2 移动互联网/云计算
⑤ AI / 边缘计算
⑥ 元宇宙
⑦ Web-3
⑧ 脑机接口
⑨ 量子
⑩ 生物基

新范式的社会影响



时代	农业化	工业化	数字化：信息无处不在	数字化：模型无处不在	数字化：行动无处不在
人作为核心生产力	人：体力为主 简单工具 没有流动性	人：体力为主，脑力为辅 机械、电器、电子等自动化工具 地域流动性	人：脑力为主，体力为辅 电脑，手机等信息化工具 全球流动性	人：创新为主，其他为辅 新一代认知思考能力工具 逐步替代脑力劳动	人：创新探索 下一代自主行动工具 全面替代脑力和体力劳动
经济范式	农业经济	商品经济	服务经济	体验经济	（暂）AI经济
代表职业	农民	工人	码农，设计师，分析师	创业者，科学家，艺术家	人类新价值系统

数字化应用-技术推动+ 需求拉动：大模型为先

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需求拉动

人类需求	消费者：需求层次 x 人群分类x 时间周期													创作者	企业：降本增效					
数字化满足人类需求六种能力	通讯	社交	内容	游戏	消费	旅游	健身	医疗	教育	金融	住房	睡眠	信息知识	食品饮料	开发者	法律	行政	OA办公	政府城市
I:信息(2D) 间接感知交互																			
II :体验 (3D) 直接具象交互																			
III: 关系 (抽象) 信任| 激励 | 所有权																			
IV:物理外部环境 就地 | 直接																			
V:生理内部感知 内部 | 直接 | 健康																			
IV:知识 | 模型 嵌入 | 启用																			

信息

自然语言为先
知识为主
行动导向
信息基础
三位一体为王

模型

行动

闭环壁垒

使用数据
模型使用
模型开发
自有数据
大模型基础

技术推动

● 科技驱动模式

-单一突破
-多点汇散
-垂直渗透
-水平扩散

模型覆盖宽度足够广

模型深度是决定因素

● 需求拉动模式

-狭窄的单点进入
-广泛的多点进入
-垂直渗透
-水平扩张

需求对知识的敏感度

需求对三位一体的敏感度

IV	⑤	知识 | 模型：嵌入和启用
V	⑧④⑤⑨	生理感受：内在且直接
IV	⑤④⑨	物理环境：就地和直接
III	⑦③④⑤⑥⑨	关系：信任| 激励 | 拥有权
II	⑥③④⑤⑦⑨	3D 体验：具体化的直接交互
I	③④①②⑤⑨	2D 信息：感知间接交互

① 个人电脑 / 磁盘操作系统
② PC客户端 服务器
③ Web-1 个人电脑互联网
④ Web-2 移动互联网/云计算
⑤ AI / 边缘计算
⑥ 元宇宙
⑦ Web-3
⑧ 脑机接口
⑨ 量子
⑩ 生物基

NLP on the Job Market

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- Positions:
  - Research scientist, machine learning engineer,
  - Product manager, algorithm engineer, software engineer, project manager, etc.

运维/技术支持	运维工程师 IT技术支持 网络工程师 网络安全 系统工程师 运维开发工程师 系统管理员 DBA 系统安全 技术文档工程师
人工智能	图像算法 自然语言处理算法 大模型算法 数据挖掘 规控算法 SLAM算法 推荐算法 搜索算法 语音算法 风控算法 算法研究员 算法工程师 机器学习 深度学习 自动驾驶系统工程师 数据标注/AI训练师
销售技术支持	售前技术支持 售后技术支持 销售技术支持 客户成功
数据	数据分析师 数据开发 数据仓库 ETL工程师 数据挖掘 数据架构师
技术项目管理	项目经理/主管 项目助理 项目专员 实施工程师 实施顾问 需求分析工程师 硬件项目经理

NLP on the Job Market

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职位描述

自然语言处理项目经验　知识图谱相关经验

岗位描述：

1.负责搜索QP核心模块研发；

2.负责多模态技术应用全力推进，如AIGC相关技术应用；

3.负责大规模NLP模型技术推进，并落地实际业务。

岗位要求：

1.扎实的数学和算法基础，并具备快速学习新技术的能力。

2.精通自然语言处理的相关技术，有电商的实践背景优先考虑。

3.在人机交互、智能问答、文本检索、多国语言处理等领域有实践经验优先；

4.良好的团队合作意识，对技术饱有热情。

工作职责:

1. 负责基于领域大模型系统的算法研究和开发，包括但不限于数据处理、模型设计、训练和调优等工作，确保系统的性能和稳定性;

2. 基于NLP基石模型，构建相应的扩展功能组件，诸如数据库、对话、反馈等，以提高系统的可扩展性和复用性;

3. 根据业务需求，完成在事理图谱构建、情感分析、地理实体、多模态等应用场景的突破性研究。

任职资格:

1.计算机、深度学习和人工智能等相关博士或博士后;

2.具有强烈的自我驱动能力，良好的沟通和团队合作能力;

3.在深度学习领域内的国际权威期刊/顶会发表过论文者优先;

4.动手和编程能力强，熟练使pytorch/tensorflow/huggingface等深度学习框架；在ACM等编程竞赛中获得奖牌者优先;

5.在重要数据集的leaderboard上排名靠前者，或者在kaggle/天池等知名竞赛中，排名Top 3%者优先优先。

【岗位名称】NLP算法研究员（深圳）

【部门】腾讯CDG企业发展事业群-金融科技（业务官网可搜：腾讯金融科技FIT）

【地点】深圳南山区滨海大厦

【职级】T8-T9

【面试】线上视频面试

【具体要求】

岗位职责：

具备大语言模型（llm）和NLP的基础知识， 能针对业务场景需求对模型进行设计和优化，完成各项任务包括不限于摘要生成、聊天对话、逻辑推理等。

任职要求：

1、自然语言处理/机器学习/强化学习/模式识别/人工智能/计算机等相关专业硕士及以上学历;

2、需要有大模型的分布式训练和NLP实际业务经验， 有大语言模型实际落地经验者更优;

3、在LLM、NLP、强化学习、机器学习等方面有一定研究基础，熟悉主流模型和算法，关注领域内的最新进展，能够跟进和实现新的算法能力;

4、了解知识图谱相关知识，有搜索、推荐相关算法工作经验优先;

5、有较强的学术比赛经验优先、有高质量论文发表者优先（如ACL、EMNLP、NeurIPS、ICML、ICLR等);

6、具备激情，好学，良好的团队合作和沟通能力。

NLP on the Job Market

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- Will NLP become the next civil engineering?
  - More talents, salary reduction, lay offs, …
- Emerging opportunities
  - Better LLMs
  - Applications of large language models
  - Machine learning operation/DevOps for machine learning (MLOps)
- What is your niche?
  - Research, engineering (technology is not everything)
  - Business, marketing
  - Hybrid

How to Learn

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- Try with official documents and examples
  - Don't be afraid. Software is designed for easier use
  - Start from basic examples, step towards the real applications
- Open courses and tutorials
  - Don't wait to be taught
  - Search and learn by yourself
  - MOOC/Wechat/Zhihu/Bilibili, etc.
- Learn from those who are willing to share

•智源社区每日分享，https://hub.baai.ac.cn/

•微博账号：爱可可-爱生活，宝玉XP，蚁工厂，

•微信公众号：PaperWeekly, 夕小瑶科技说，机器之心，李rumor

How to Learn

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SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

- Two possible pattern
  - Learning process: what -> why -> how
    - Technician vs. engineer vs. researcher/scientist
  - Research process (sometimes): what -> how -> why
- Another two possible pattern
  - Deep-first search
  - Width-first search
  - Lean thinking (精益开发)
- Five ‘knowledge’ learned in the university

Data Science vs. Computer Science

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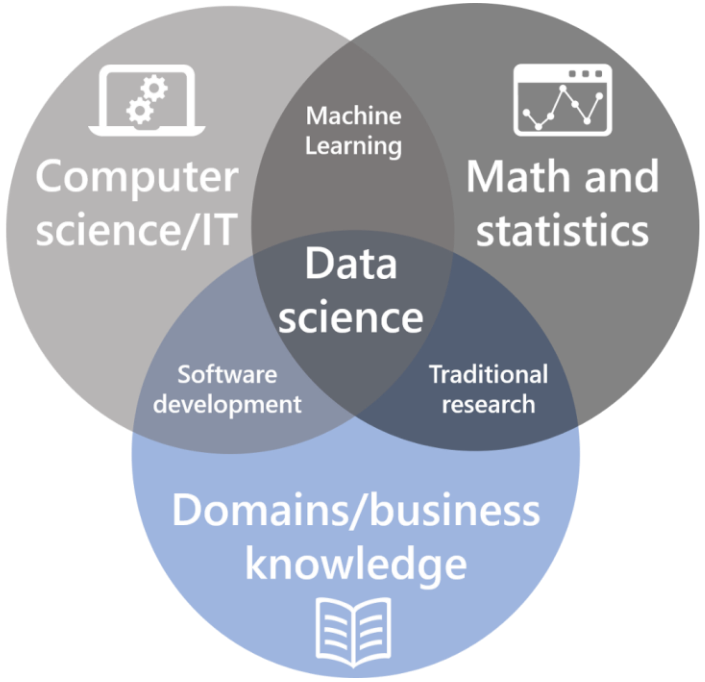
- Computer science
  - Theory and practice of computing and coding
  - Everything from software to the operating systems they run on, and to the base hardware that interacts with the OS
- Data science
  - Aim at real-world problems
  - Work for understanding of how business works and how to improve
  - Emphasis more on using instead of designing

CS自学指南



More reading: https://www.indeed.com/career-advice/finding-a-job/data-science-vs-computer-science

GPU Resources

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- Google Colab
  - Free for 12 hours, buy pro/pro+
- 阿里天池
  - Free for 60 hours，8 hours/each
  - 天池大赛
- Kaggle GPU
  - Running Kaggle Kernels with a GPU
- AutoDL

Learning Resources

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SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

- CS224N: Natural Language Processing with Deep Learning
- COS 484: Natural Language Processing
- Huggingface NLP course

Thank you