

Promptly Racing Ahead: A Survey on Multi-task Prompt-Based Learning

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Multi-task Prompt Based Learning

Motivation

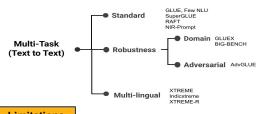
- > Rapid Progress on Prompt-based Learning Methods due to Large Language Models (LLMs)
- > Recent methods focus on Multi-tasking capabilities.
- > Lack of Systematic Review.

Prompt Learning Multi-task Prompt Learning 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

Goals:

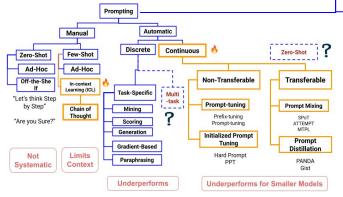
> Organize & Compare the literature on Multi-Task Prompt Based Learning. > Identify Emerging & Future Directions.

Benchmark Datasets



Limitations

- > Misleading Metrics: MCQ Evaluation, Non-Linear Metrics?
- > Negative Task Transfer: Which tasks should be combined to form dataset?
- > Presence in Pre-training Dataset: Memorization in LLMs



Emergent Tasks?

- > Definition: "An ability is emergent if it is not present in smaller models but present in larger models," [1]
- > Scaling Factors: Compute for Training, Number of Parameters, Dataset
- Emergent Tasks: Truthfulness. Toxicity classification, **BIG-BENCH**

Arguments against Emergence

- > *Metrics:* Using non-linear methods of evaluation metrics (accuracy) gives a "mirage" of emergence. Linear metrics (per token probability) show
- no evidence of emergence. [2] > Training Data: No clarity if same or similar tasks in pre-training data. different training data for models

Future Work

- > Parameter-Efficient Methods (PEFT): [3] Add more Parameter Efficient Methods
- > Other Modalities, Multi-Modalities; Explore Video, Audio, Images. Multi-modal prompt based methods [4.5]

Future Directions

Fixed Prompt

> Continuous Prompts:

Task-Specific

Manual

Prompts

"PET"

Generative

Prompts

"GenPET"

"I M-RFF"

"LM-BFF-MS"

Underperforms

a) Applications: Using Prompts to bounds outputs, Symbolic Operations b) Architecture Agnostic Prompts: Cross Architecture Prompt Use

Prompt Based

Fine-tuning

Meta-Training

Unified Prompt

Templates

"Multi-task Prompted

Training"

Task-Specific

Template

"UniFew"

"Instruction Tuning"

ICL-Based

"Meta-ICL"

Restricted to

Large Models

Tunable Prompt

Shallow

Fine-tuning

"DART"

"P-tunina"

Deep

Fine-tuning

"P-Tuning V2"

Trade offs in

Performance

#Parameters

Open Question/Gap

Emerging Direction

"Method

Limitation

- c) Knowledge Transfer: Zero-Shot Way to transfer knowledge
- d) Understanding Tradeoffs of Parameter Efficient Methods

> In-context Learning:

- a) Scaling: Make it Insensitive to Order of Examples
- b) Investigation: How does it work + Which Tasks Perform Well?
- > Benchmark Datasets: Use Linear Metrics?, Better ways to
- > Multi-Modal Applications: E.g Unified-IO, Multi-Modal Benchmark Datasets
- > Memorization, Biases, Negative Task Transfer : Investigation in Large Language Models [5]

References

- [1] Wei, Jason, et al. "Emergent abilities of large language models." arXiv preprint arXiv:2206.07682 (2022).
- [2] Schaeffer et al. "Are Emergent Abilities of Large Language Models a Mirage?"
- [3] Ding, Ning, et al. "Delta tuning: A comprehensive study of parameter efficient methods for pre-trained language models." arXiv preprint arXiv:2203.06904 (2022).
- [4] Khattak, Muhammad Uzair, et al. "Maple: Multi-modal prompt learning." arXiv preprint arXiv:2210.03117 (2022)
- [5] Zhao, Jinming, et al. "Memobert: Pre-training model with prompt-based learning for multimodal emotion recognition." ICASSP 2022-2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), IEEE, 2022. [6] Akvürek, Afra Fevza, et al. "On measuring social biases in prompt-based multi-task learning," arXiv preprint arXiv:2205 11605 (2022)