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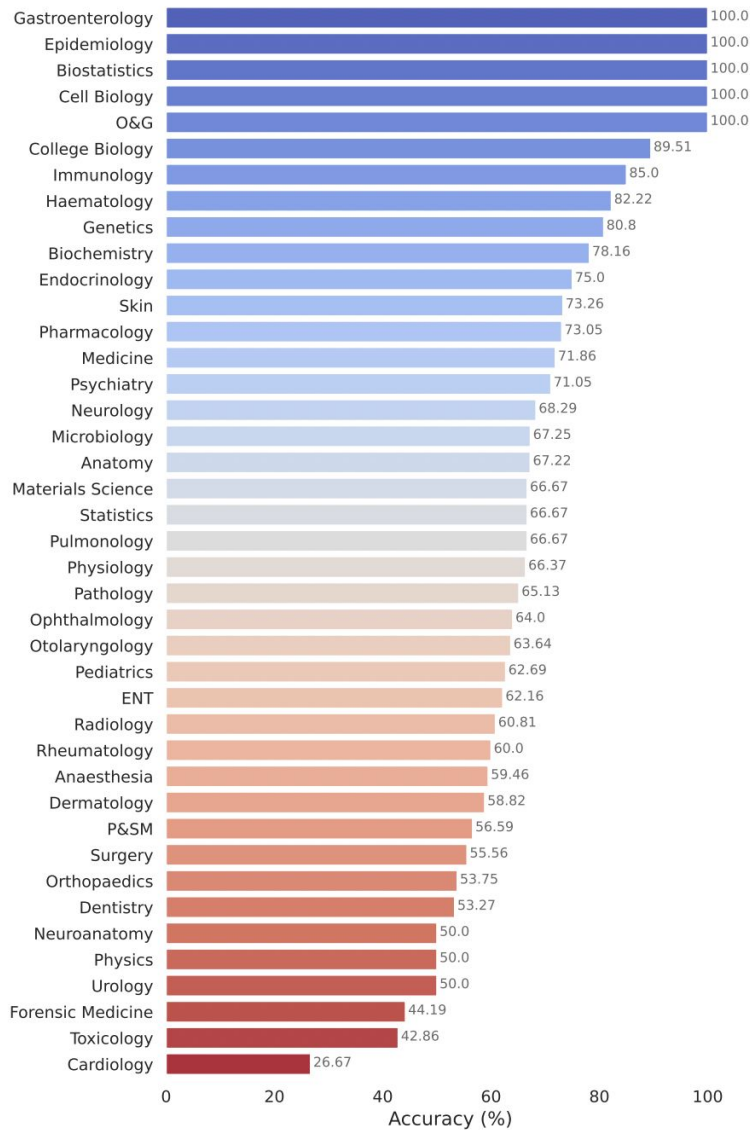
Fine-Tuning Llama Language Models for Support in Heart Transplantation

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Language models for Healthcare

- Great potential
- Knowledge gaps
- GDPR concerns



Gemini Goes to Med School

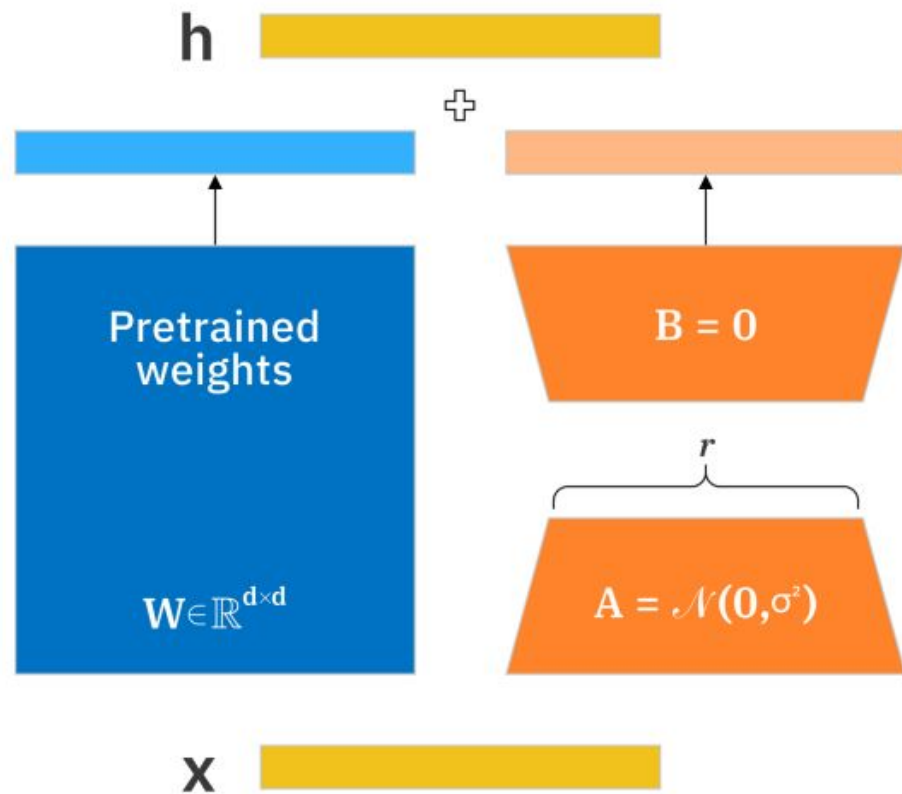
Source: <https://arxiv.org/pdf/2402.07023>



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LoRA

During training



$$h = Wx + BAx$$

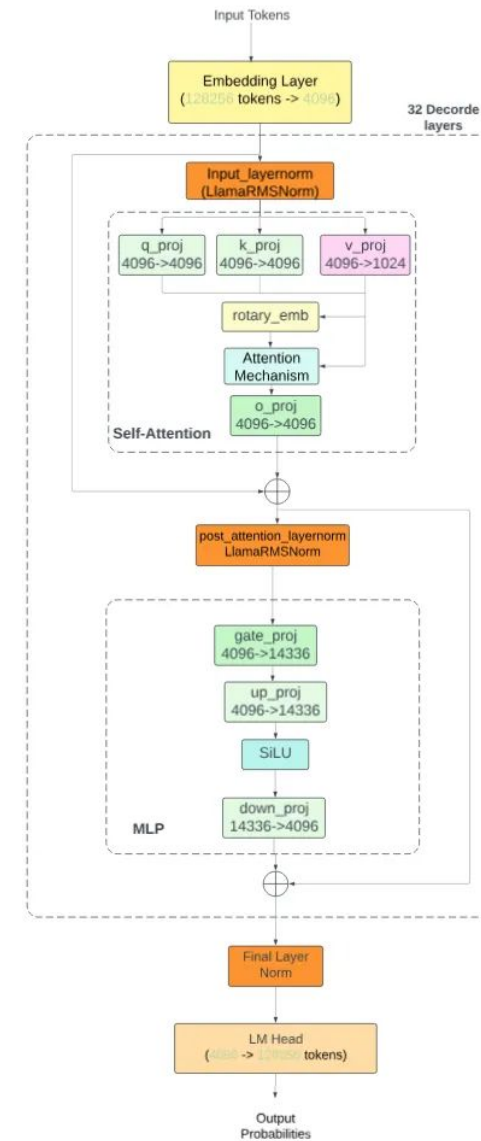
$$h = \underbrace{(W + BA)}_{W_{merged}}x$$

After training



Llama 3.1

- 8 billion parameters
- Open source
- Decoder-only Transformer

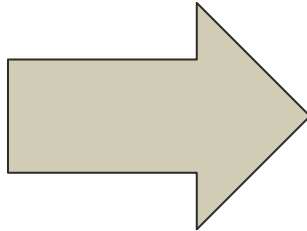


Instruction-Tuning

- Supervised Fine-Tuning
- Model learns by following instructions
- Instruction = Medical question

Turning text into questions and answers

Marie Curie was a pioneering physicist and chemist who conducted groundbreaking research on radioactivity. She was the first woman to win a Nobel Prize, and the only person to win Nobel Prizes in two different scientific fields—Physics and Chemistry. Born in Poland in 1867, she later moved to France, where she did much of her scientific work. Curie's discoveries laid the foundation for modern nuclear science, and her work remains influential today.



Q: Who was the first woman to win a Nobel Prize?

A: Marie Curie

Q: What fields did Marie Curie win Nobel Prizes in?

A: Physics and Chemistry

Q: Where was Marie Curie born?

A: Poland

Q: In what year was Marie Curie born?

A: 1867

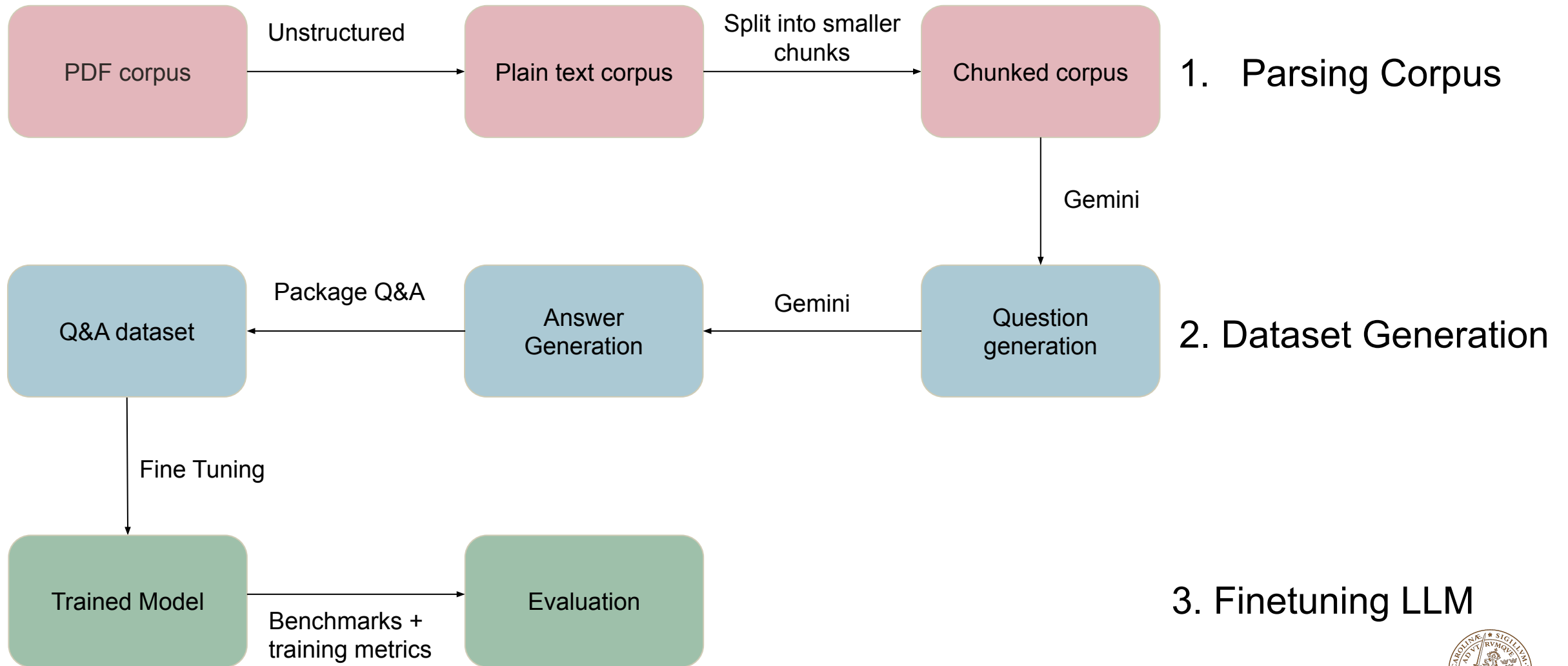
Q: What scientific topic did Marie Curie research?

A: Radioactivity

Q: Why is Marie Curie's work still important today?

A: It laid the foundation for modern nuclear science.

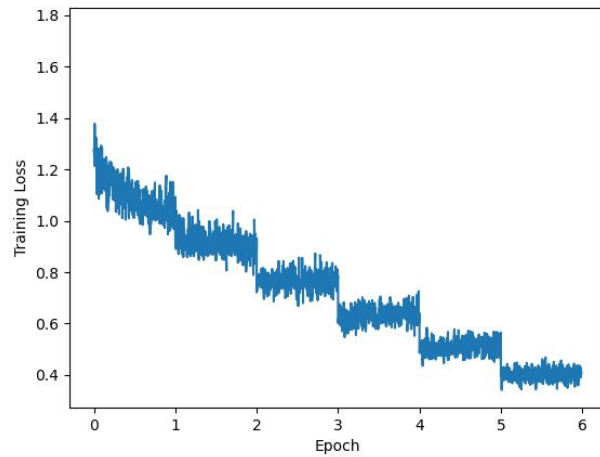




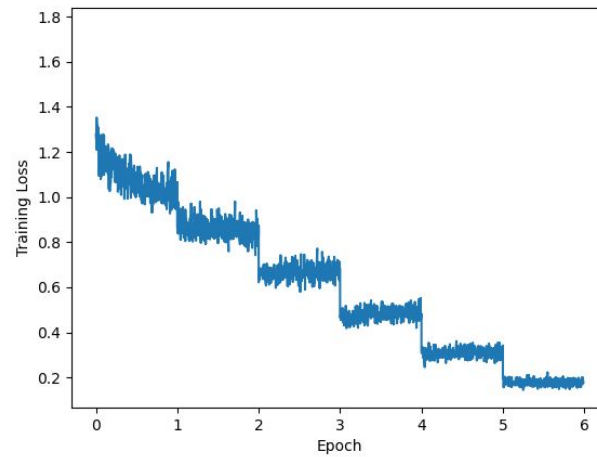
Evaluation

- Cross entropy loss
- BLEU, Rouge, Bert-score
- Accuracy
- Human evaluation

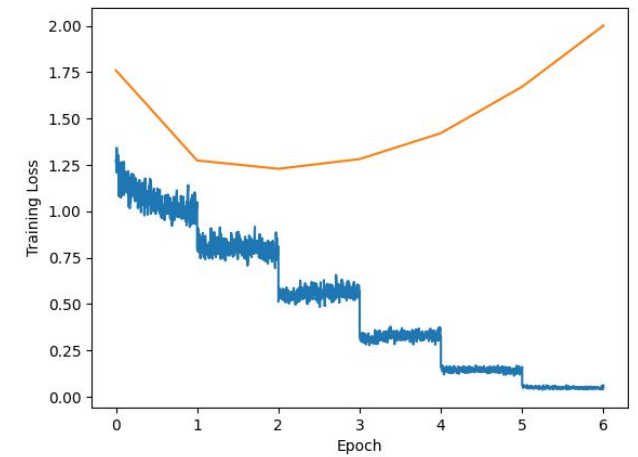
Training data



LoRA rank = 16



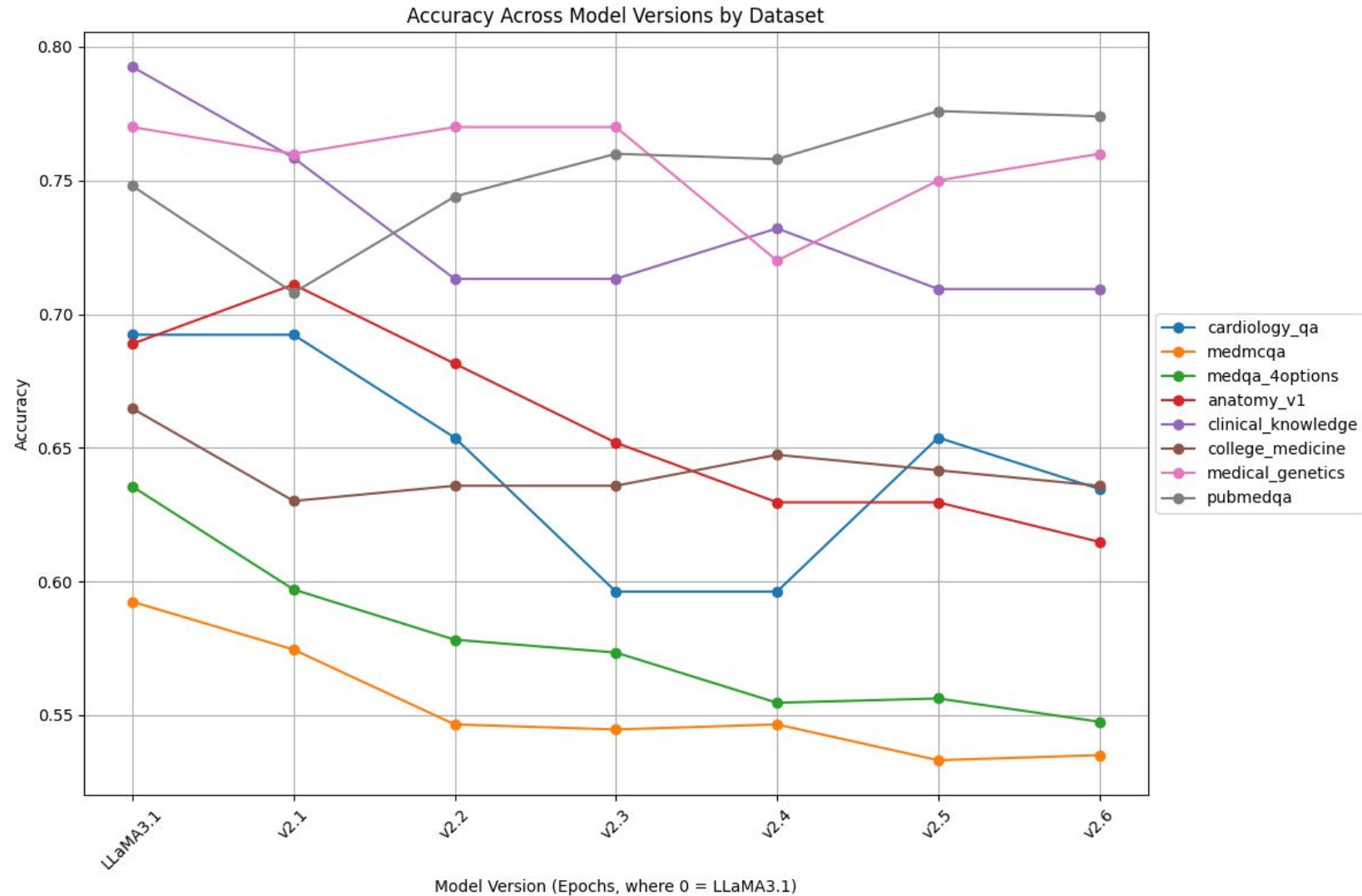
LoRA rank = 32



LoRA rank = 64

Evaluation against benchmarks

- Worse at general medicine
- No good benchmark for heart surgery



Hyperparameter improvements

- Epochs and LoRA rank
- Training and inference
- Black Box Optimisation

Issues with instruction-tuning on new knowledge

- Model learns to mimic the style of answers, but fails to learn about heart transplantation
- QA Format \neq Optimal Knowledge Encoding
- Initial Continuous Pre-Training might have increased performance

Question: What element did Marie Curie discover?

Instruction-tuned answer:

Marie Curie, the renowned physicist and chemist who was awarded the Nobel Prize in both Physics and Chemistry, is credited with the groundbreaking discovery of the chemical element radium. Her pioneering work in the field of radioactivity, alongside her husband Pierre Curie, led to the isolation of radium from uranium ore in the late 1890s. This discovery not only expanded the periodic table but also laid the foundation for future research in nuclear physics and medicine. Therefore, the element she discovered is radium.

Short answer:

Radium.

Acknowledgements

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