Think Bayesian

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Bayesian Data analysis and Probabilistic Programming

Credits

- Chap. 1 of *Bayes Rules! An Introduction to Applied Bayesian Modeling*
  - https://www.bayesrulesbook.com/chapter-1.html

The big picture

- We continuously update our knowledge about the world as we accumulate experience or collect data.
- The Bayesian probability is a rigorous framework for modeling the knowledge-building process, using data to update your knowledge.

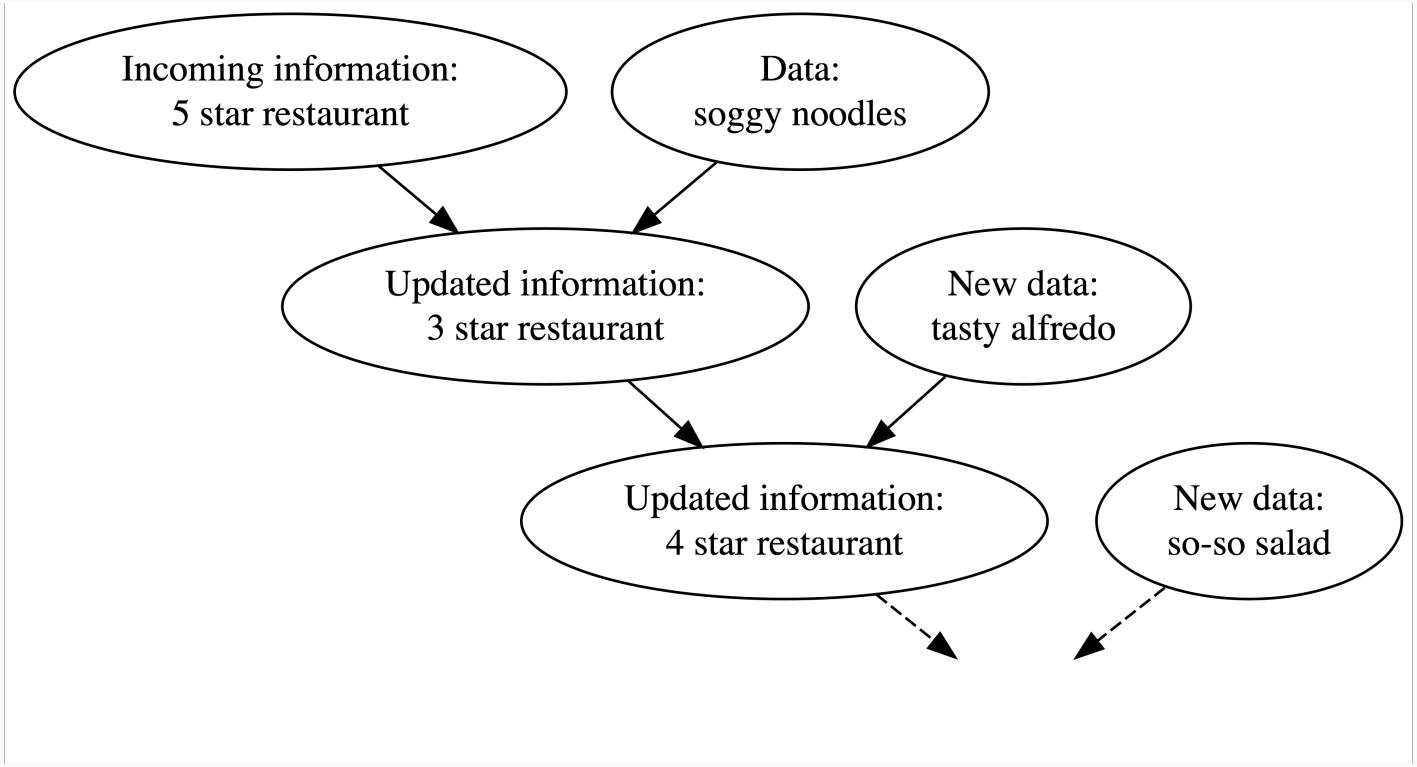
Changing opinion based on experience

- Suppose there's a new restaurant with high online rating.
- Prior to enter the restaurant, you expect that it will be delicious.
- On your first visit, the pasta is poorly cooked.
- You weigh the high online rating against your poor meal (which might have just been a fluke), and you update your opinion knowledge: this is a medium, not an excellent restaurant.

Changing opinion based on experience

- In your second meal at the restaurant you're pleased with your dinner and increase your personal restaurant's rating to good.
- You continue to visit the restaurant, collecting edible data and updating your knowledge each time.
- After enough visits, you have your own informed opinion.

Building knowledge

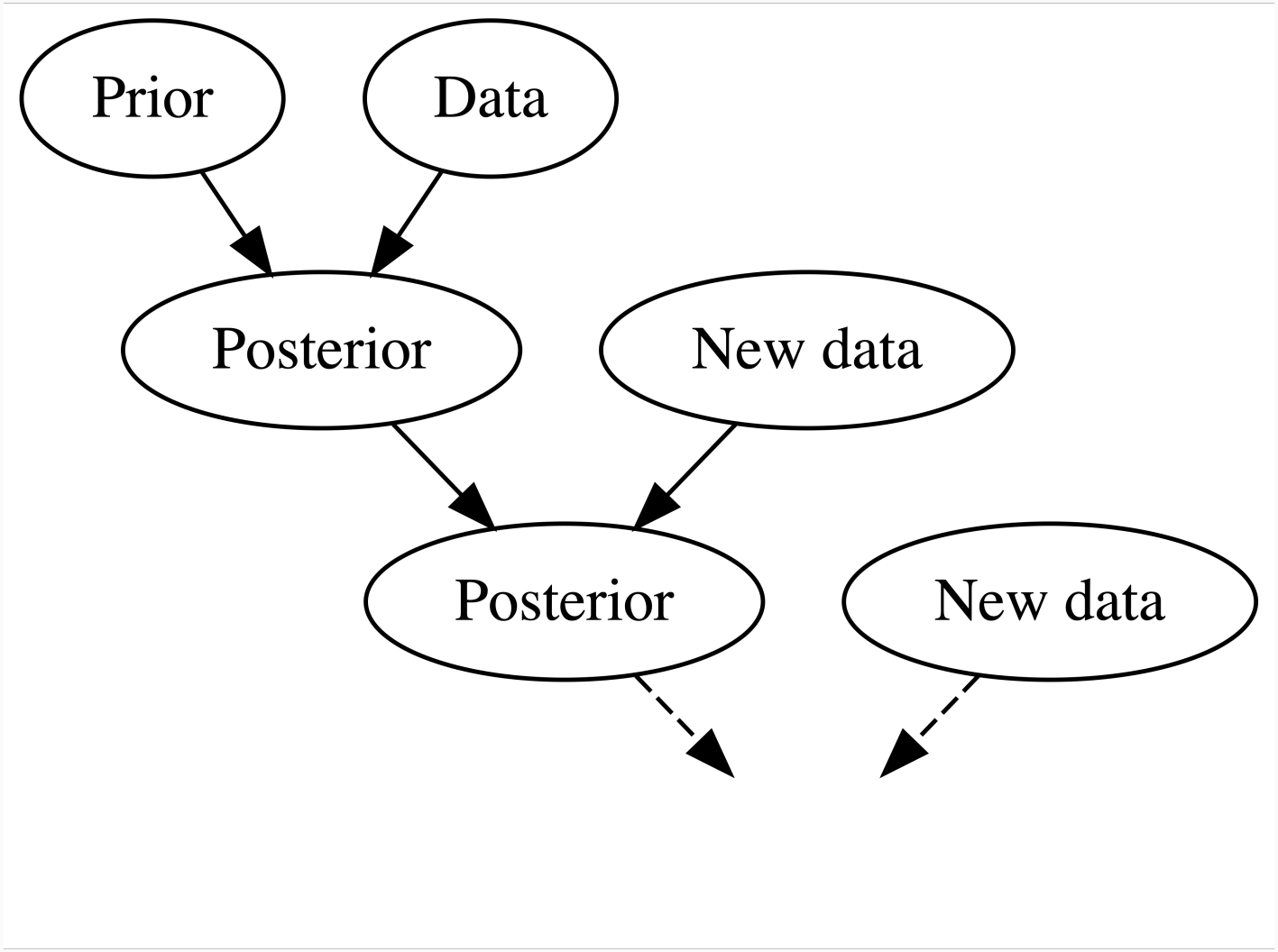


- We can apply this same Bayesian process to rigorous research inquiries.

Building knowledge

- An environmental scientist analyses of the human role in climate change.
- He carries a degree of incoming or prior information based on previous research and experience.
- In light of this information he interprets new data, considering both to develop an updated understanding (posterior information).
- He continues to refine this information as he gathers new evidence.

Building knowledge



Thinking Bayesian

- When flipping a fair coin, we say that “the probability of flipping Heads is 0.5.” How do you interpret this probability?
- If I flip this coin over and over, roughly 50% will be Heads.
- Heads and Tails are equally plausible.

Thinking Bayesian

- An election is coming up and a pollster claims that candidate A has a 0.9 probability of winning. How do you interpret this probability?
- If we observe the election over and over, candidate A will win roughly 90% of the time.
- Candidate A is much more likely to win than to lose.