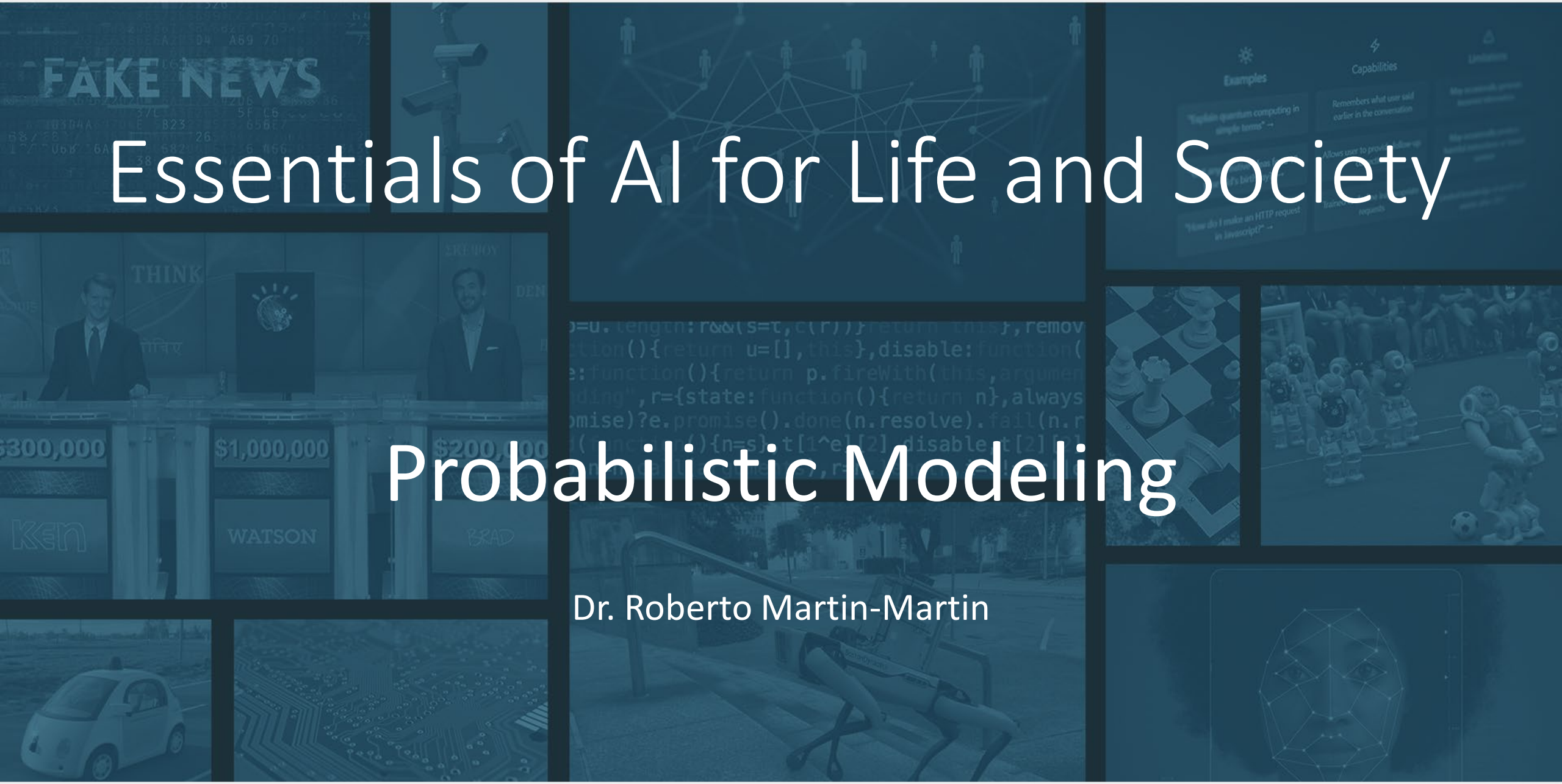


Essentials of AI for Life and Society

Probabilistic Modeling

Dr. Roberto Martin-Martin

Defining Artificial Intelligence

A science and a set of computational technologies that are inspired by, but typically operate quite differently from, the ways people use their nervous systems and bodies to sense, learn, reason, and take action

More than just Deep Learning → Probabilistic Modeling!

Defining Artificial Intelligence

A science and a set of computational technologies that are inspired by, but typically operate quite differently from, the ways people use their nervous systems and bodies to sense, learn, reason, and take action

More than just Deep Learning → Probabilistic Modeling!

Statistical approach that uses the effect of random occurrences or actions to forecast the possibility of future results

Defining Artificial Intelligence

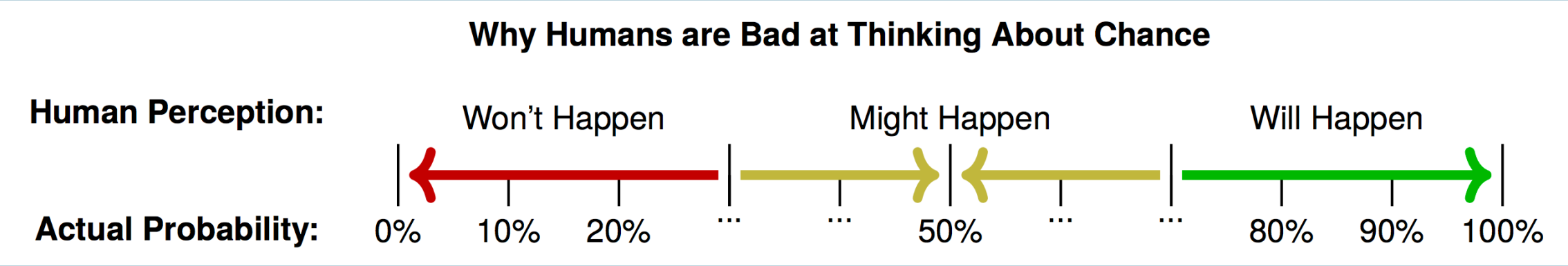
A science and a set of computational technologies that are inspired by, but typically operate quite differently from, the ways people use their nervous systems and bodies to sense, learn, reason, and take action

More than just Deep Learning → Probabilistic Modeling!

Statistical approach that uses the effect of random occurrences or actions to forecast the possibility of future results

We “round” probabilities very coarsely…

- Humans are bad at estimating accurate chances of events to happen
- We tend to simplify in three cases:
  - Won’t happen ~ 0% probability
  - Might happen ~ 50/50 probability
  - Will happen ~ 100% probability



We are bad with large numbers…

- 1 every 10.000 clovers have four leaves

- 8.000.000.000 people in the world
  - 0.0001 % of them see a clover every day
  - 800.000 people see a clover every day
- ~80 people find a 4-leaf clover every day!

Instapoll

Why Probabilistic Modeling?

- We (humans) are really bad at computing probabilities in our heads
  - Probabilistic modeling gives us tools to do it in a rigorous way
- The world is not deterministic
  - Same actions can lead to different outcomes
  - Some effects cannot be predicted
  - Some data is noisy
- Classic logic does not account for ”possibilities”
  - if A then (always) B
  - what if sometimes B and sometimes C?

Probabilistic Modeling

- The tools to correctly reason based on the chances of different events to happen
- Critical to make informed decisions!

Example

- John has two children
- We know that one of them is a girl
  - It could be the youngest or the oldest
- What is the probability that the other is a boy?

- Intuition: ½

Example

- John has two children
- We know that one of them is a girl
  - It could be the youngest or the oldest
- What is the probability that the other is a boy?

- Intuition: ½

  WRONG!

Example

- John has two children
- We know that one of them is a girl
  - It could be the youngest or the oldest
- What is the probability that the other is a boy?

- Intuition: ½

  WRONG!

BB BG GB GG

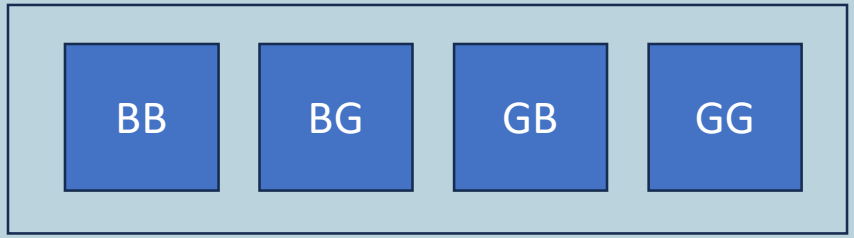
\+ one is G

Example

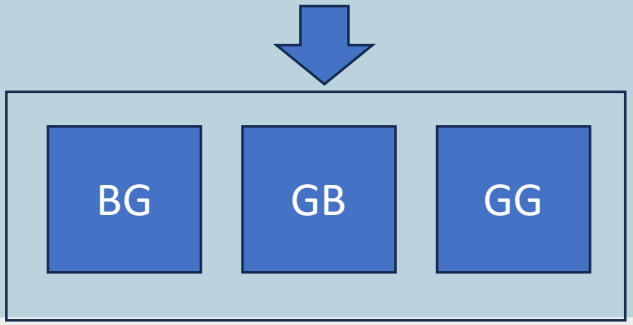
- John has two children
- We know that one of them is a girl
  - It could be the youngest or the oldest
- What is the probability that the other is a boy?

- Intuition: ½

  WRONG!



+ one is G



Example

- John has two children
- We know that one of them is a girl
  - It could be the youngest or the oldest
- What is the probability that the other is a boy?

- Intuition: ½

  WRONG!
- Right value: 2/3!