Probability Introduction

Week 02 - Day 04

Probability

Probability = chance of an event (coin flip, result of a match, etc.)

$$P(\text{head}) = 0.5 = 50\%$$

$$P(\text{tail}) = 0.5 = 50\%$$

Axioms

Axiom 1: non negativity

The probability of an event is greater or equal to zero

$P(A) >= 0$

P(Head) = -0.7 ???

Axiom 2: unit measure

The probability of all the possible events is 1

P(head) + P(tail) = 1

Axiom 2: additivity

P(Head or Tail) = P(head) + P (Tails)

(disjoints events = “non overlapping” = mutually exclusive)

Properties

1 - Probability of No Event

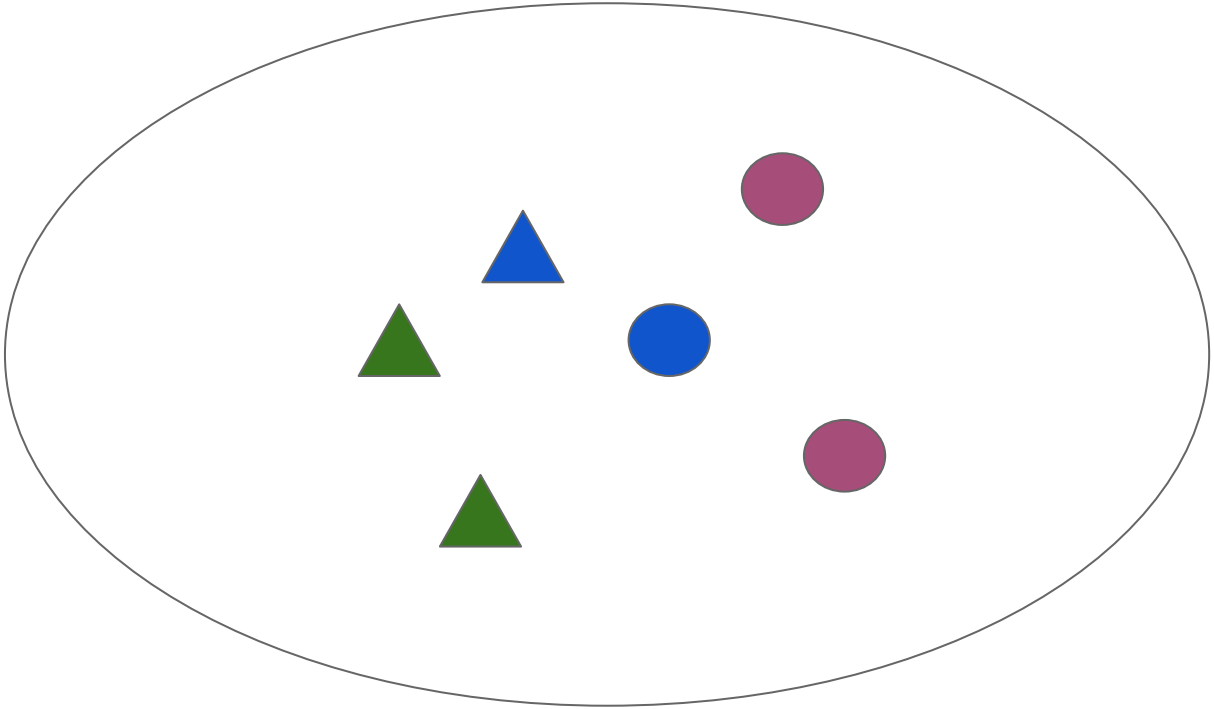
is zero!... (it’s either tail or head)

2 - Probability of A or B (union)

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

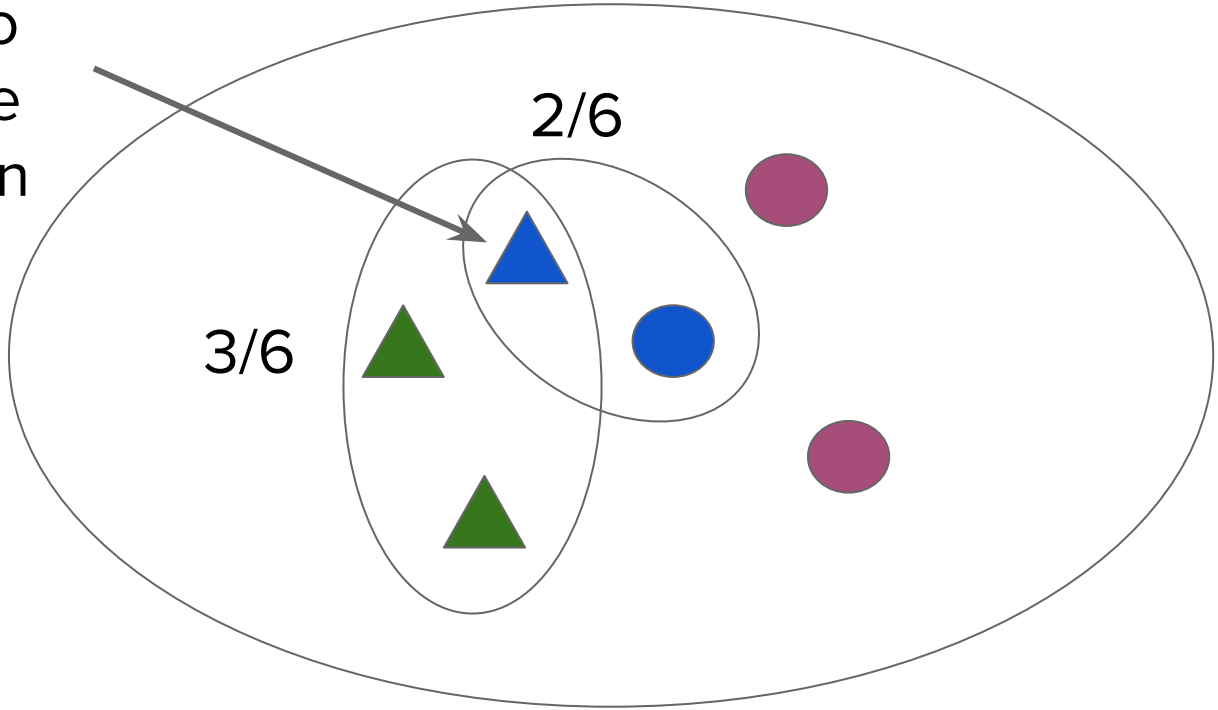
If no overlapping -> just P(A) + P(B)

P(triangle U blue) = ?



P(triangle U blue) = ?

We have to remove the intersection



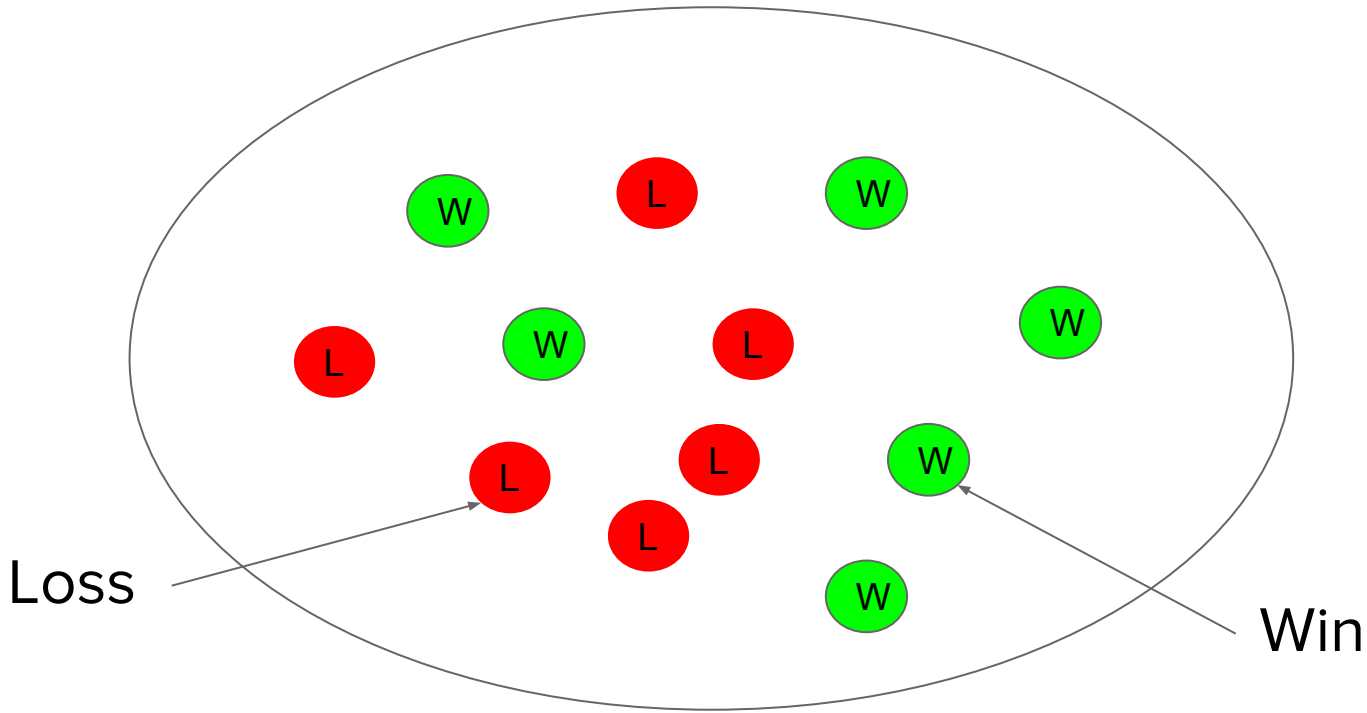
3 - Conditional Probability

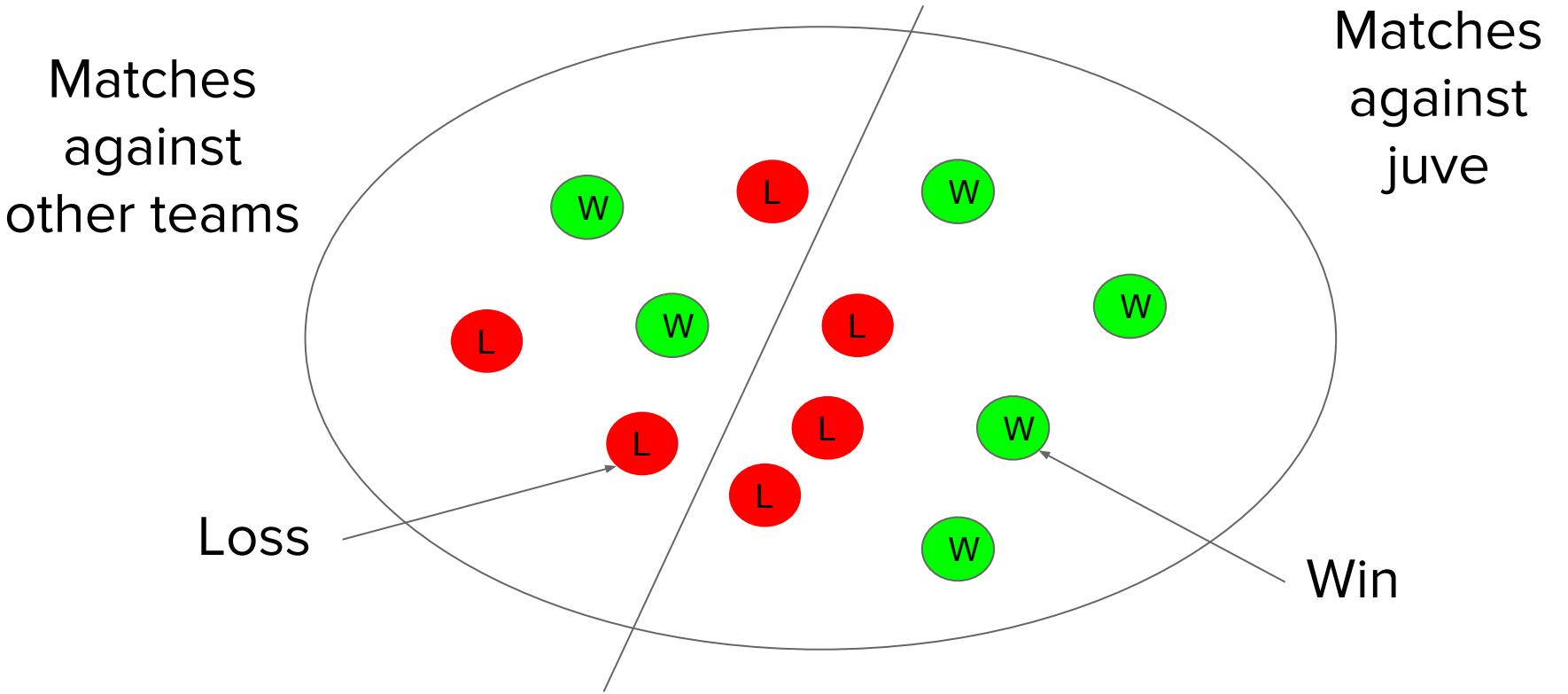
$P(A|B) = P(A \cap B) / P(B)$

1) Useful for ML
2) Example: P(good movie | category=romantic)

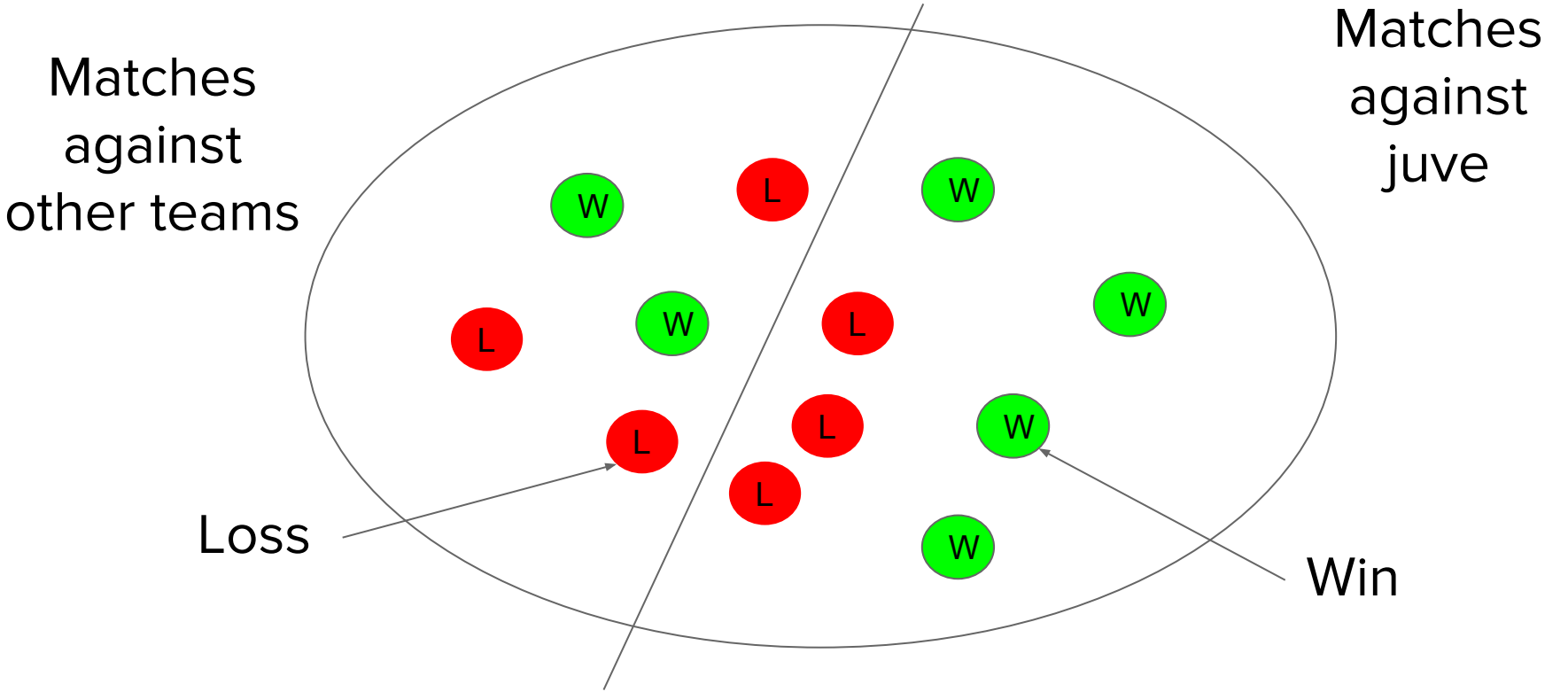
Example

P(win | play against juventus)

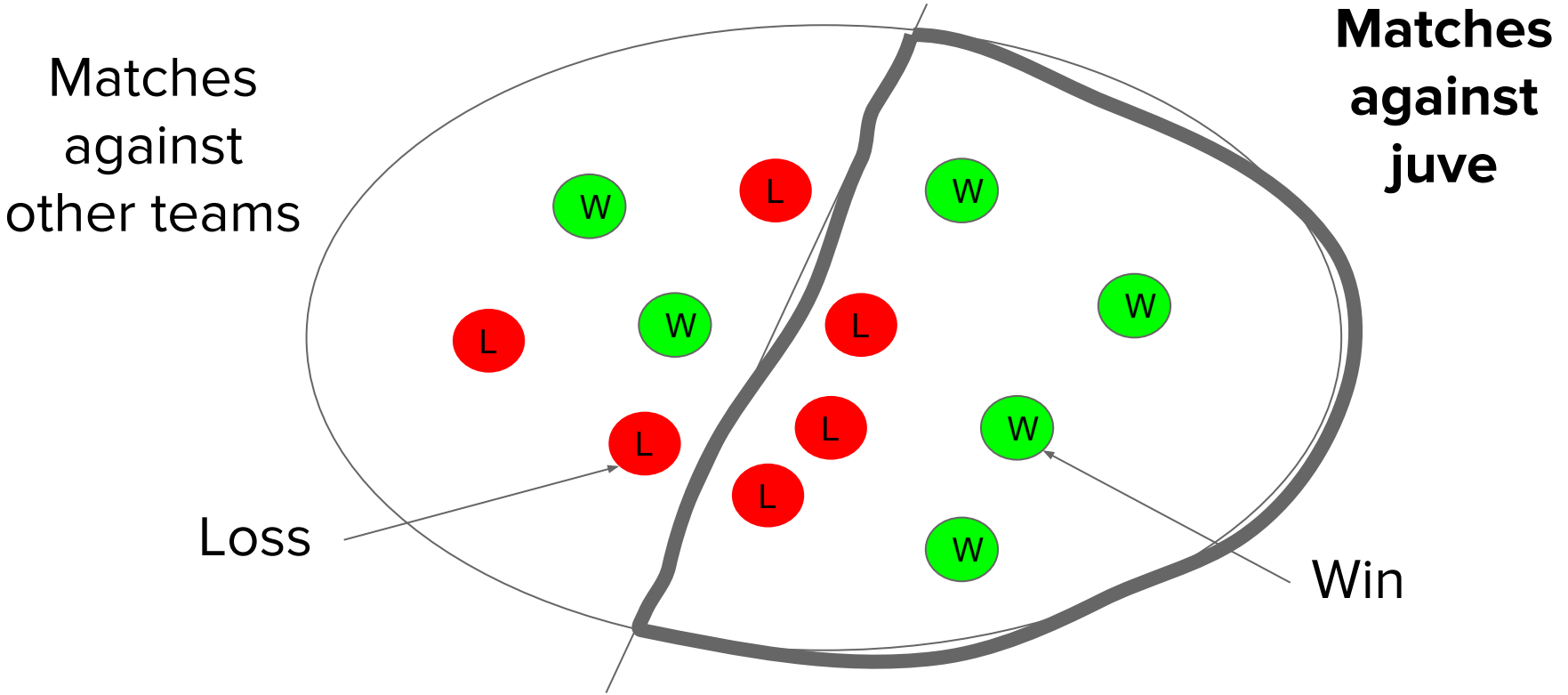

W
L
W
W
L
L
W
L
L
W
L
W
Loss
Win


Matches against other teams
Matches against juve
W
L
W
W
L
W
L
L
L
W
L
W
Loss
Win

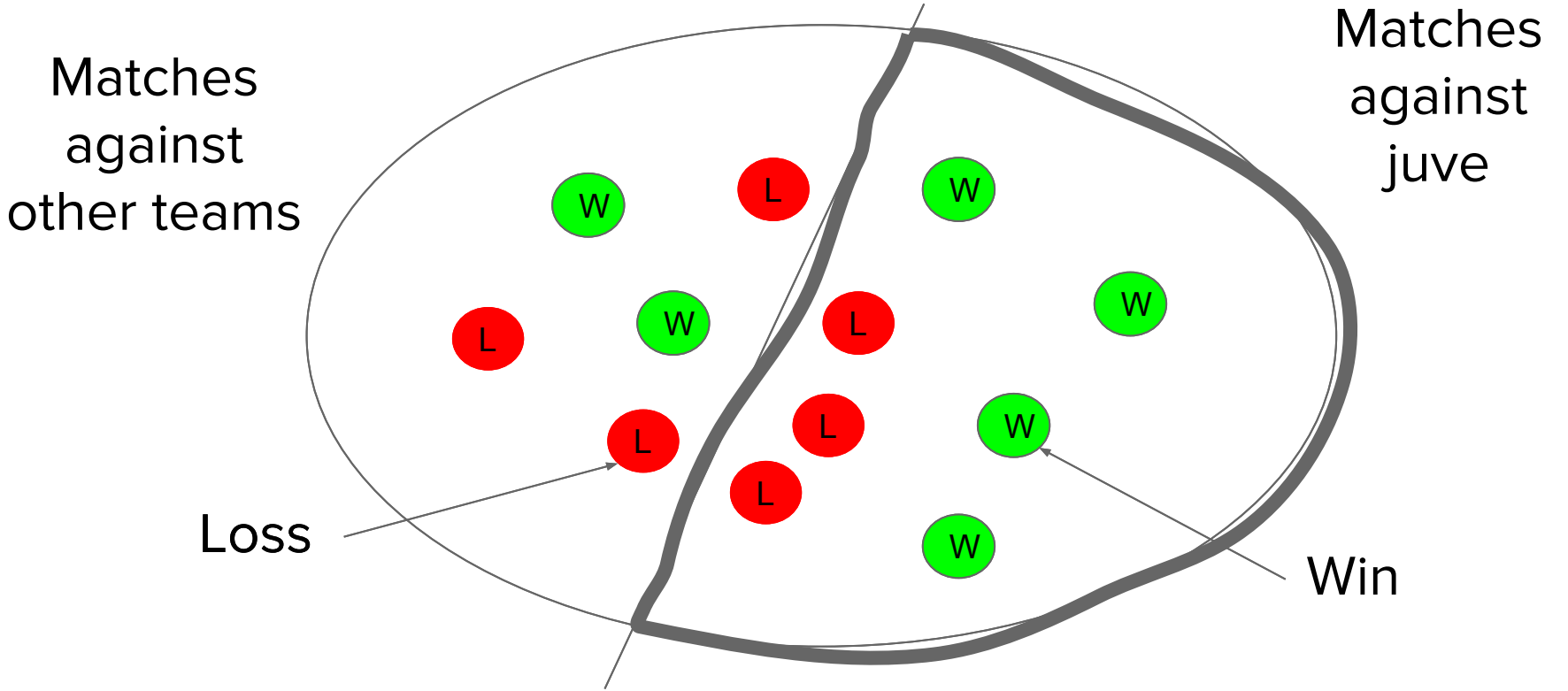
P(win | playing against juve) = ?



P(win | playing against juve) = ?



P(win | playing against juve) = **4/7**



4 - Joint probability

$P(A \cap B) = P(A|B) * P(B)$

Just play with the previous formula!

5 - Total probability

video

Combinatorics

Basic definition

Combinatorics is the study of how sets can be enumerated

“How many strings of 5 letters can I build using only [a,b,e,n,o].”

Counting principle

3 girls = (a,b,c)

4 boys = (1,2,3,4)

How many possible couples like (girl,boy) can you have?

Counting principle

a1,a2,a3,a4

b1,b2,b3,b4

c1,c2,c3,c4

4x3 = 12 -> double for loop! :)

Permutations

Video

Combinations

Video

With replacement (sampling)

The same element can be chosen more than one time

Birthday paradox

https://en.wikipedia.org/wiki/Birthday_problem

Lesson material

Skip:

Distinguishable vs. Indistinguishable *("balls and urns")*

What to do

If you are new to probability

Get the basics: P(a and b), P(a or b), P(alb), etc.

If you are OK to probability

Play with combinatorics