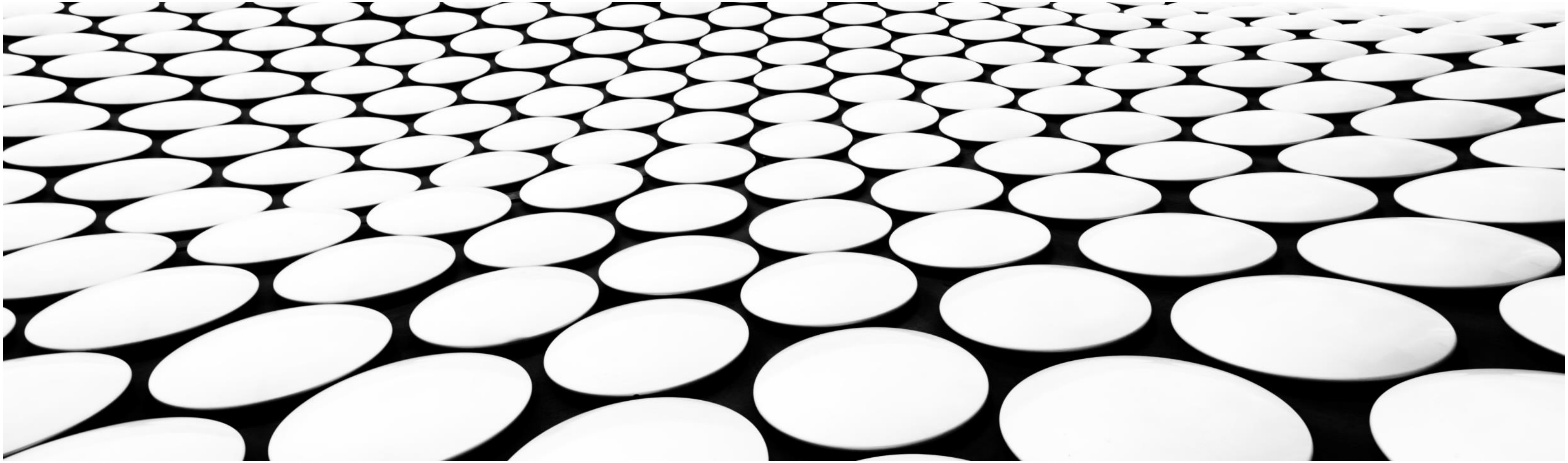
NAIVE BAYES CLASSIFIER

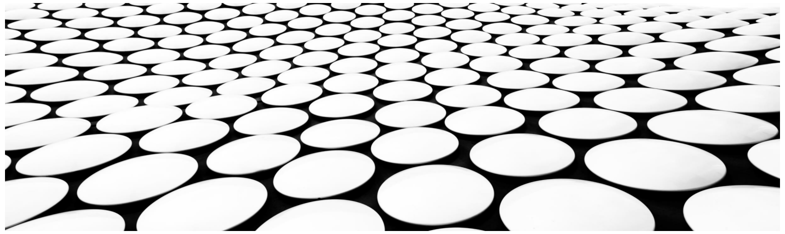
PART 1 OF 3 – REVIEW OF PROBABILITIES



GOALS

- Reviewing probabilities toward the Bayes Rule

DEFINITIONS



Elementary event
An elementary or atomic event is an event that cannot be made up of other events.

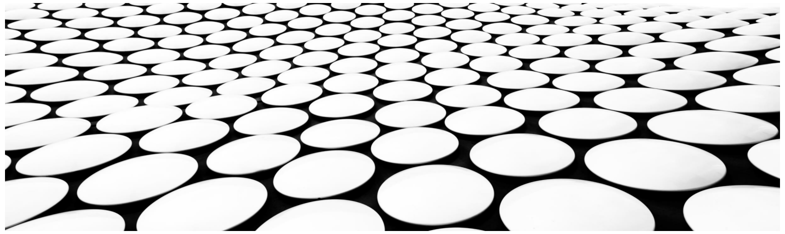
Event, E
An event is a set of elementary events.

Sample space, S
The set of all possible outcomes of an event E is the sample space S.

Probability, p
The probability of an event E in a sample space S is the ratio of the number of elements in E to the total number of possible outcomes of the sample space S of E.

Thus, $p(E) = |E| / |S|$.

DICE ROLLING EXAMPLE



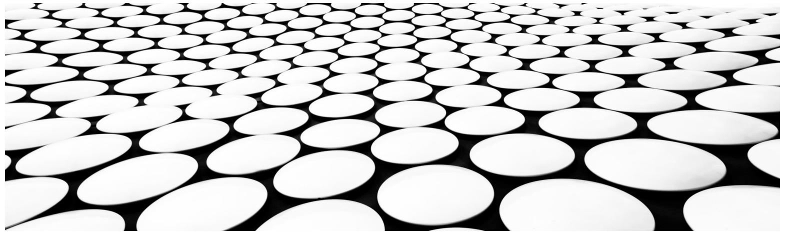
Elementary event
A roll of 2 dice.

Event, E
The rolls making the sum of 7 between the dice.

Sample space, S
The set of all possible 2-dice rolling outcomes: {1,1}, {1,2}, {1,3}, …., {3,3}....{5,2}, …{6.6}

Probability, p(E)
Sum = 7 → {1,6}, {2,5}, {3,4}, {4,3}, {5,2}, {6,1}
p(E) = |E| / |S| = 6 / 36

PROPERTIES

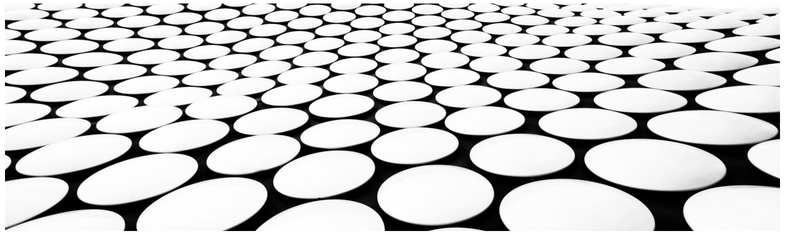


Bounds of p(E)
$0 \leq p(E) \leq 1$, where $E \subseteq S$

Maximum probability mass = 1
Sum of the probabilities of all possible outcomes in S is 1.

Complements
$p(\neg E) = 1 - p(E)$

PROBABILITY OF MULTIPLE EVENTS

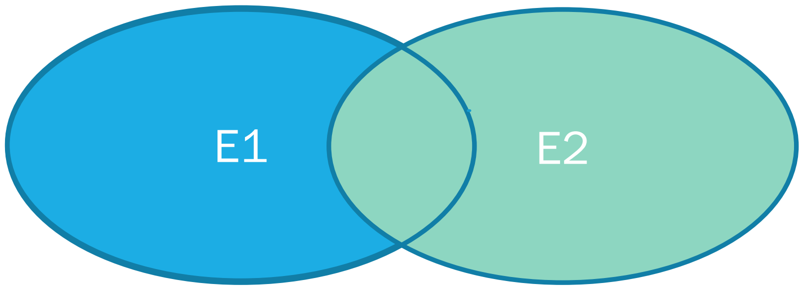


Union of E_1 and E_2 - Either of the event happening

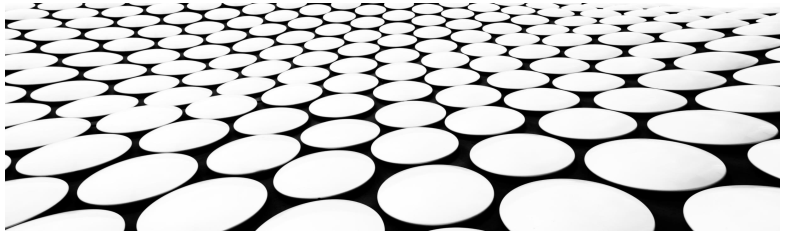
$P(E_1 \cup E_2) = p(E_1) + p(E_2) - p(E_1 \cap E_2)$

Conditional probability of E_1 given E_2 - Supposes E_2 has happened

$P(E_1|E_2) = p(E_1 \cap E_2) / P(E_2)$



DICE ROLLING EXAMPLE

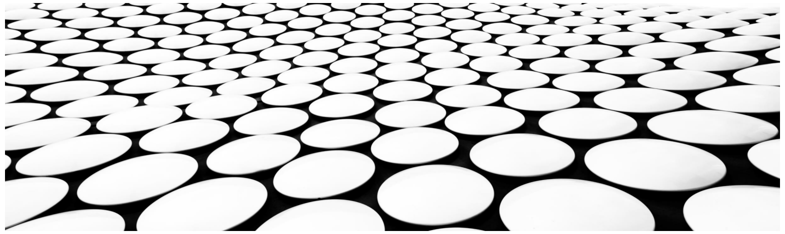


Event A ⟶ 2-dice rolls providing a sum of 6
{1,5}, {2,4}, {3,3}, {4,2}, {5,1}

Event B ⟶ 2-dice rolls where the outcome of one dice is twice the outcome of the other dice
{1,2}, {2,1}, {2,4}, {4,2}, {3,6}, {6,3}

Probability of any of the two events happening?
$P(A \cup B) = p(A) + p(B) - p(A \cap B) = 5/36 + 6/36 - 2/36 = 9/36$

DIRE ROLLING EXAMPLE

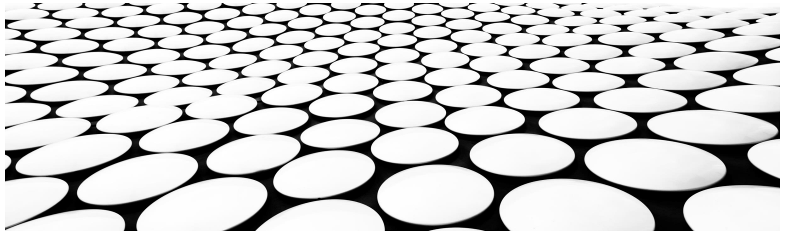


Event A → 2-dice rolls providing a sum of 6
{1,5}, {2,4}, {3,3}, {4,2}, {5,1}

Event B → 2-dice rolls where the outcome of one dice is twice the outcome of the other dice
{1,2}, {2,1}, {2,4}, {4,2}, {3,6}, {6,3}

Probability of A if B has already happened?
$P(A|B) = p(A \cap B)/p(B) = (2/36) / (6/36) = 1/3$

BAYES RULE



$p(A|B) = p(A \cap B) / p(B)$ *(eq. 1)*
$p(B|A) = p(A \cap B) / p(A)$ *(eq. 2)*

Rewrite equation 2 above:
$p(A \cap B) = p(B|A)*p(A)$ *(eq. 3)*

Insert equation 3 in equation 1
$p(A|B) = p(B|A)*p(A) / p(B)$ *(eq. 4)*

Bayes Rule

LET'S CONTINUE…

Next video:
Naive Bayes classifier