# PATTERNS

# DEFINITION

- A pattern is an arrangement of descriptors.

- The name feature is used often in the pattern recognition literature to denote a descriptor.
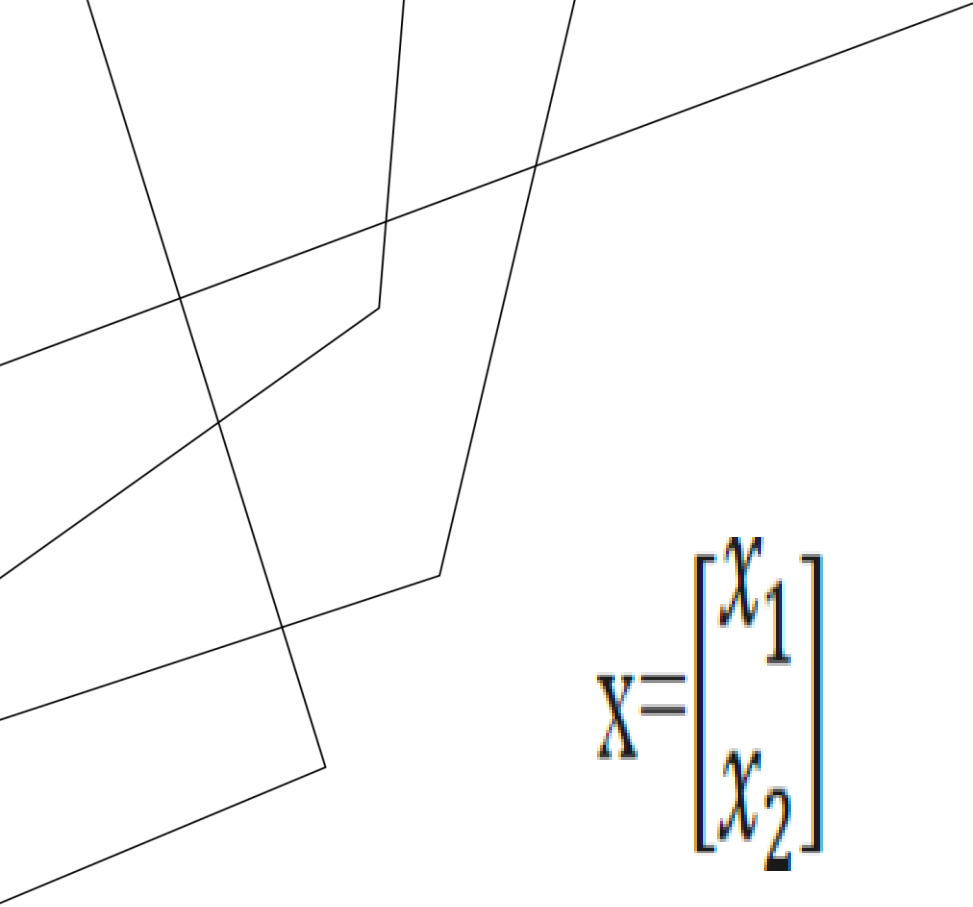
# PATTERN CLASSES

- a family of patterns that share some common properties.

- Pattern classes are denoted $\omega_1, \omega_2, \ldots\ldots\ldots, \omega_W$, where W is the number of classes.

- Pattern recognition by machine involves techniques for assigning patterns to their respective classes— automatically and with as little human intervention as possible.
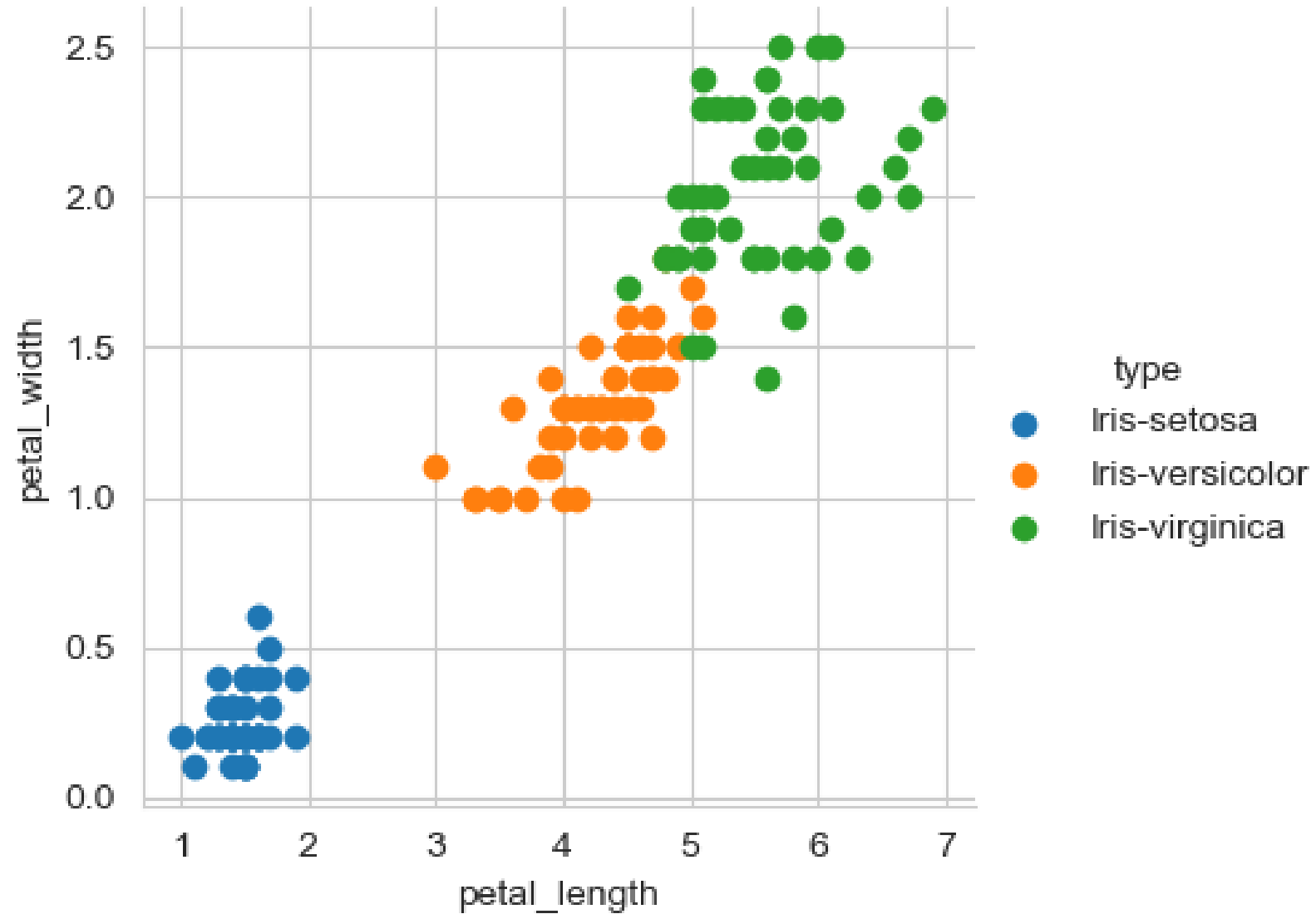
# PATTERNS ARRANGEMENT

❖Three common pattern arrangements used in practice are vectors (for quantitative descriptions) and strings and trees (for structural descriptions).

❖Pattern vectors are represented by bold lowercase letters, such as x, y, and z, and take the form where each component, xi, represents the ith descriptor and n is the total number of such descriptors associated with the pattern.

❖Pattern vectors are represented as columns (that is, n x 1 matrices). Hence a pattern vector can be expressed in the form shown in figure

$$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ x_n \end{bmatrix}$$

$$X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

- The nature of the components of a pattern vector x depends on the approach used to describe the physical pattern itself.

- In our present terminology, each flower is described by two measurements, which leads to a 2-D pattern vector of the form in the figure, where x1 and x2 correspond to petal length and width, respectively.

- In our example we will consider the length and width for three types of the iris flower (**setosa, virginica, and versicolor**), which are the three pattern classes in this case, denoted ω1, ω2, and ω3, respectively.

- Because the petals of flowers vary in width and length, the pattern vectors describing these flowers also will vary, not only between different classes, but also within a class.

# VECTORS ARRANGEMENT

# STRINGS ARRANGEMENT



W= abababababababab…..

# TREES ARRANGEMENT
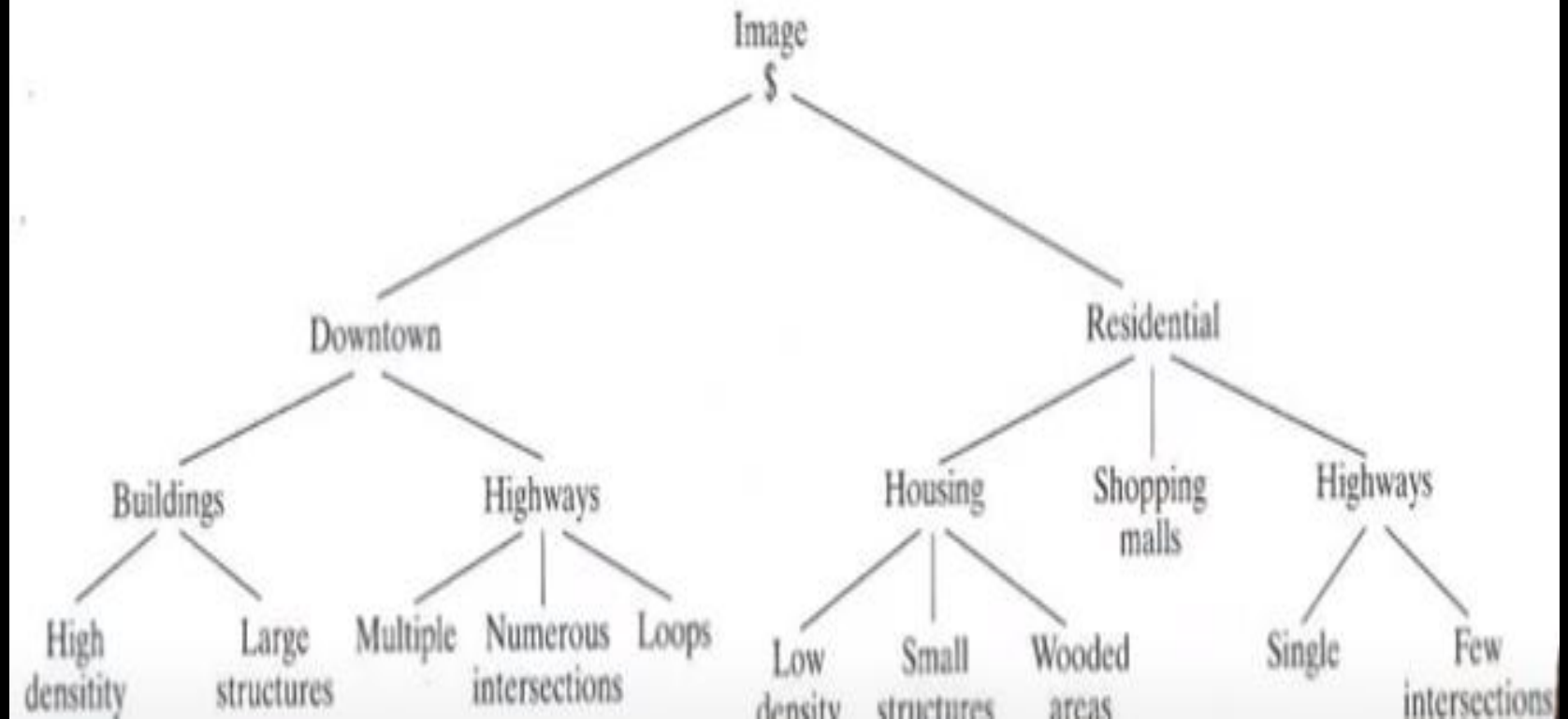
# PROTOTYPE MATCHING

- a theory of pattern recognition that describes the process by which a sensory unit registers a new sample and compares it to the prototype.

- n exact match is not expected for prototype-matching, allowing for a more flexible model. An object is recognized by the sensory unit when a similar prototype match is found.
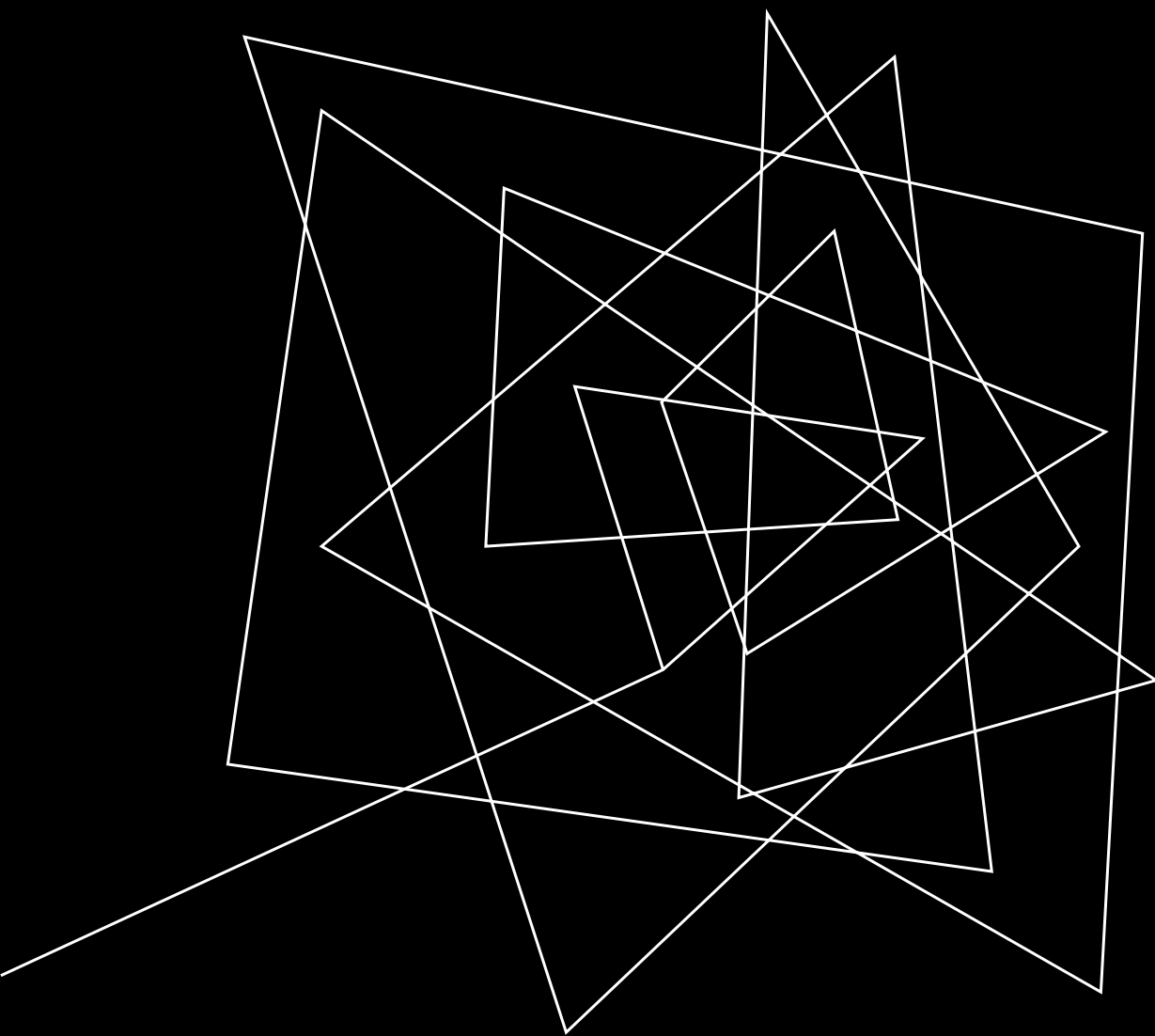
BAYES OPTIMAL
CLASSIFIER

BAYES THEORY

➢ Bayes theorem provides a principled way of calculating a conditional probability.

➢ It involves calculating the conditional probability of one outcome given another outcome, using the inverse of this relationship, stated as follows:

P(A | B) = (P(B | A) * P(A)) / P(B)

# DEFINITION

- The Bayes optimal classifier is a probabilistic model that makes the most probable prediction for a new example, given the training dataset.

- This model is also referred to as the Bayes optimal learner, the Bayes classifier, Bayes optimal decision boundary, or the Bayes optimal discriminant function.

- It means that any other algorithm that operates on the same data, the same set of hypotheses, and same prior probabilities cannot outperform this approach, on average. Hence the name "optimal classifier."

- Bayes Error: The minimum possible error that can be made when making predictions.