

INTRO to DATA SCIENCE

LECTURE 3: MACHINE LEARNING

I. WHAT IS MACHINE LEARNING?

from Wikipedia:

“Machine learning, a branch of artificial intelligence, is about the construction and study of systems that can learn from data.”

source: http://en.wikipedia.org/wiki/Machine_learning

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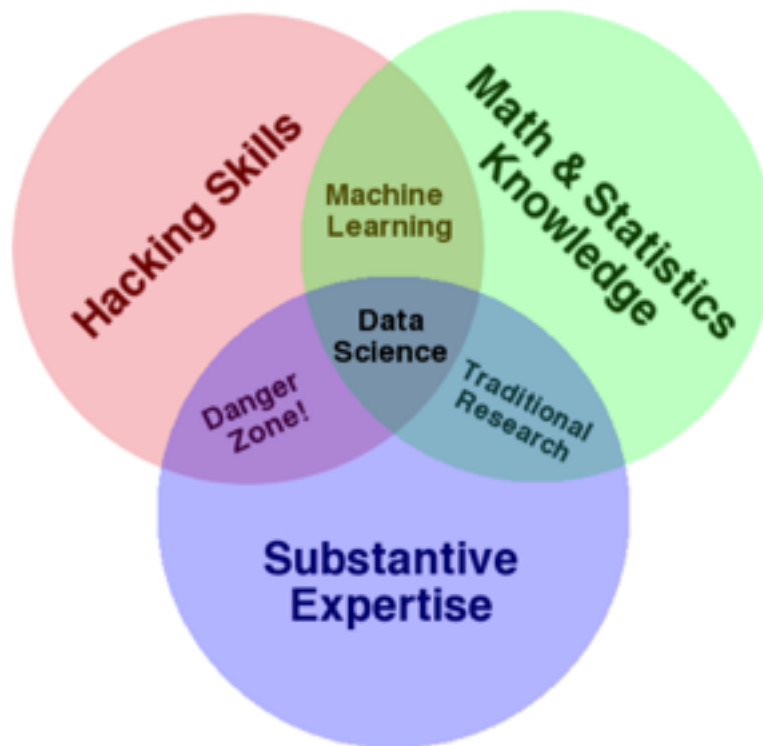
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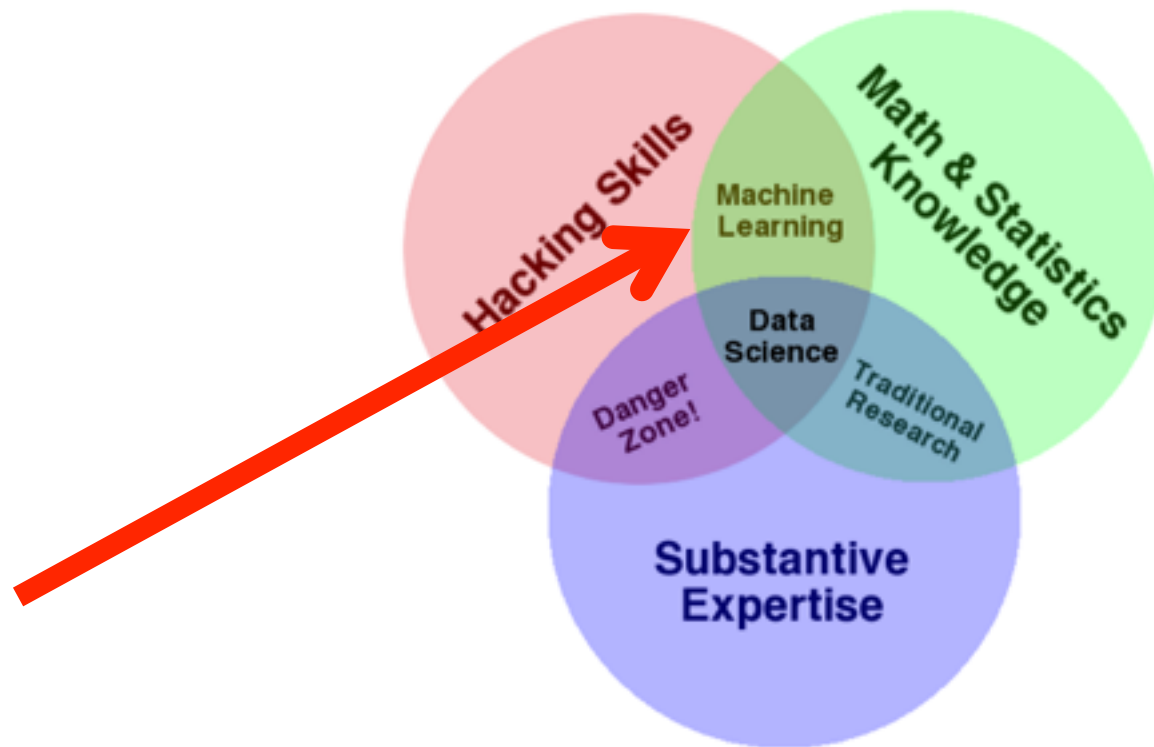
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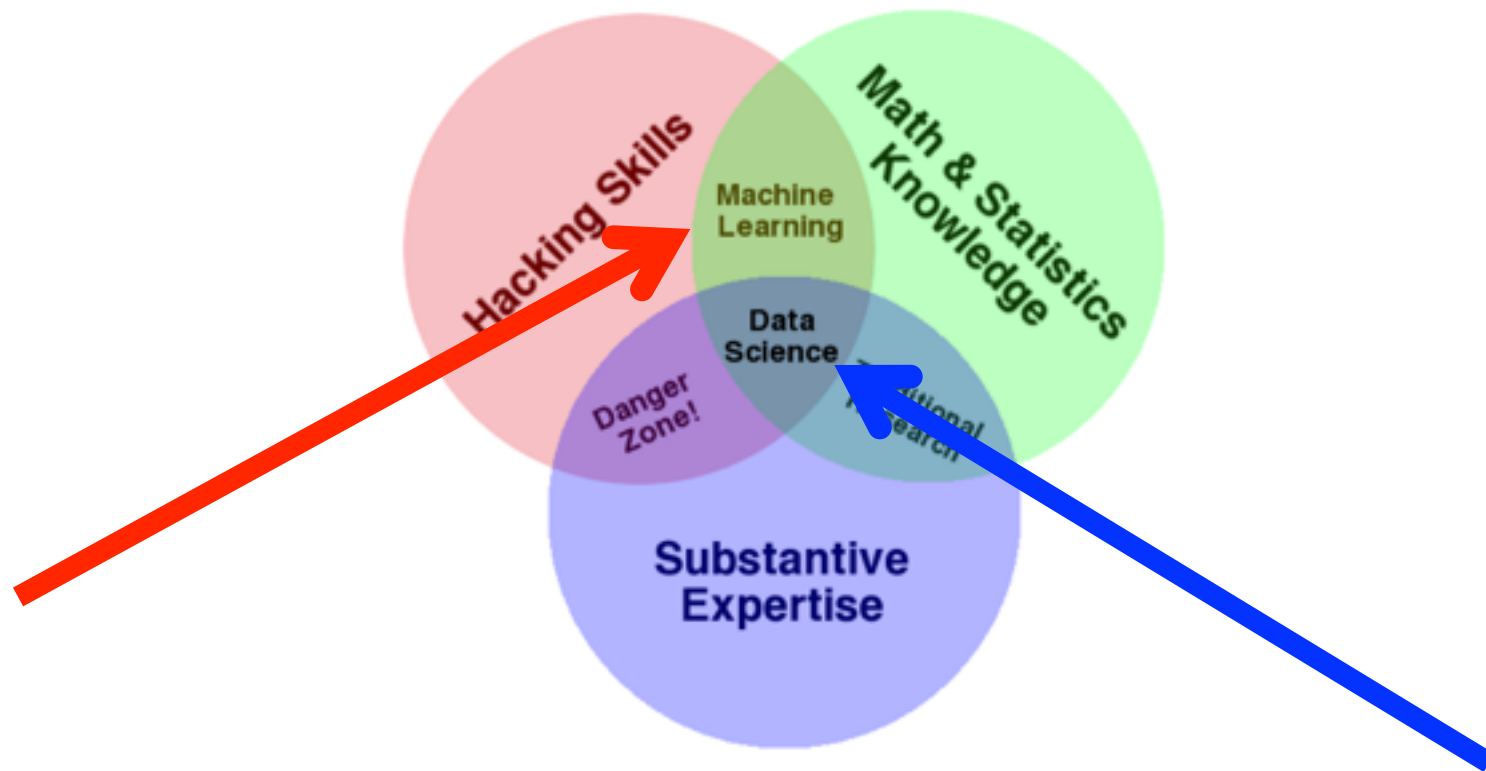
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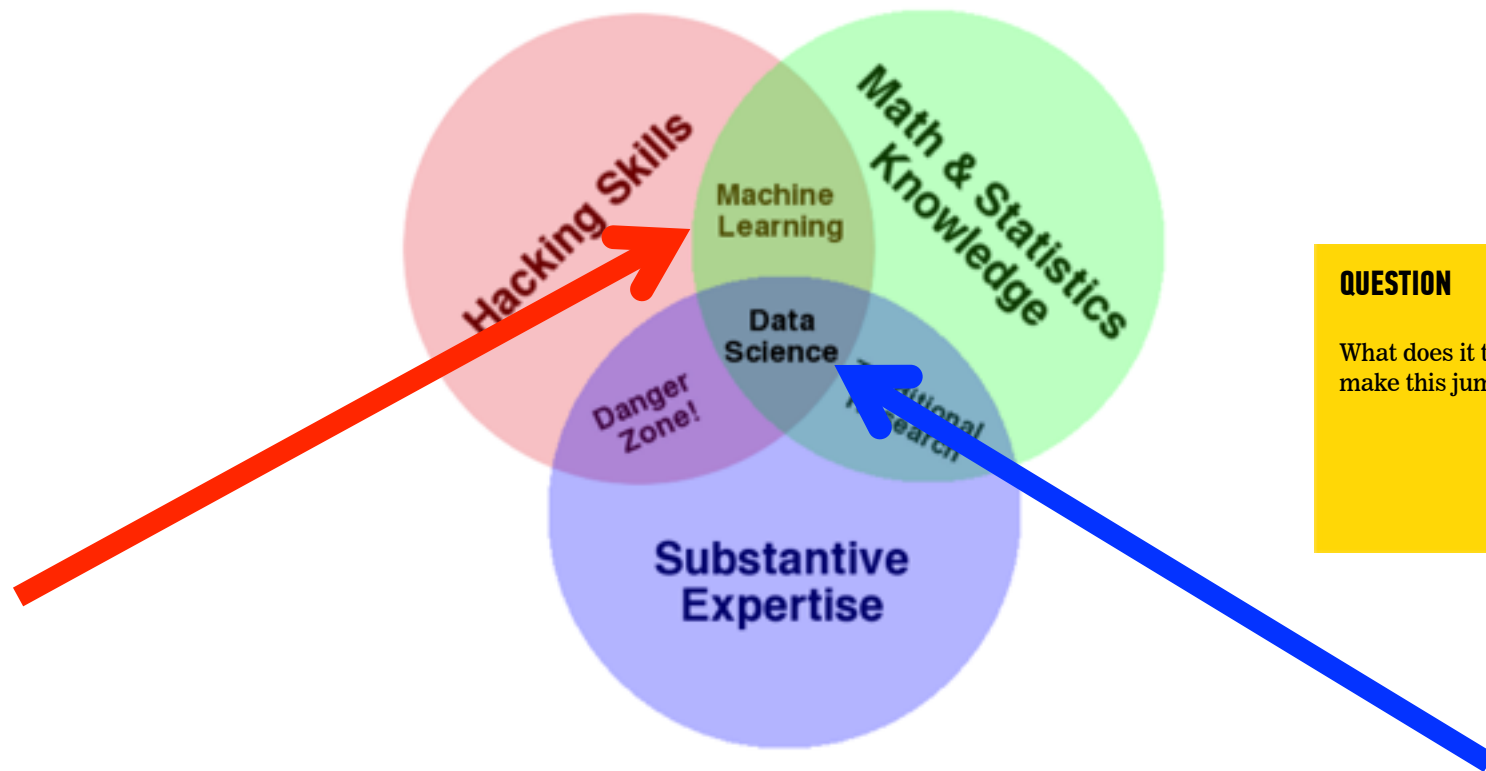
- representation – extracting structure from data
- generalization – making predictions from data

source: http://en.wikipedia.org/wiki/Machine_learning







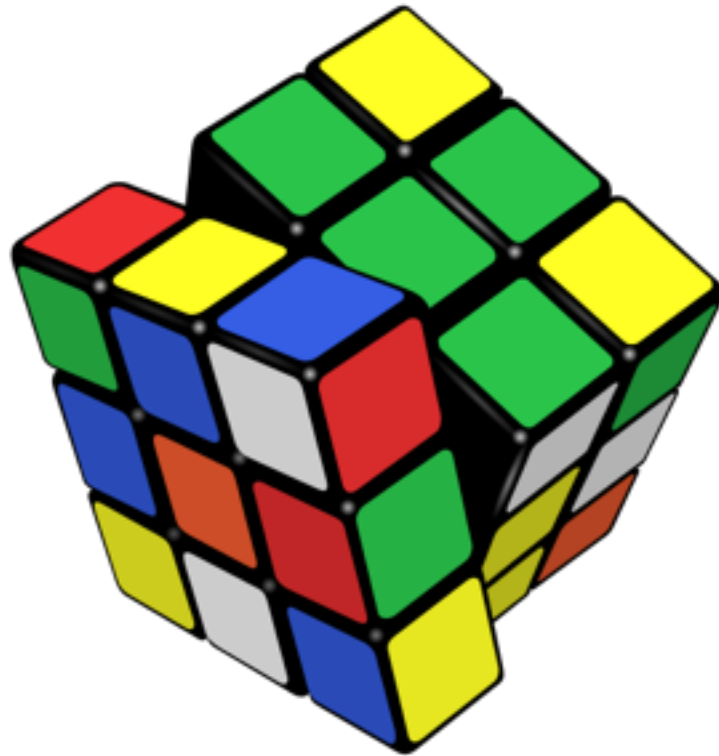


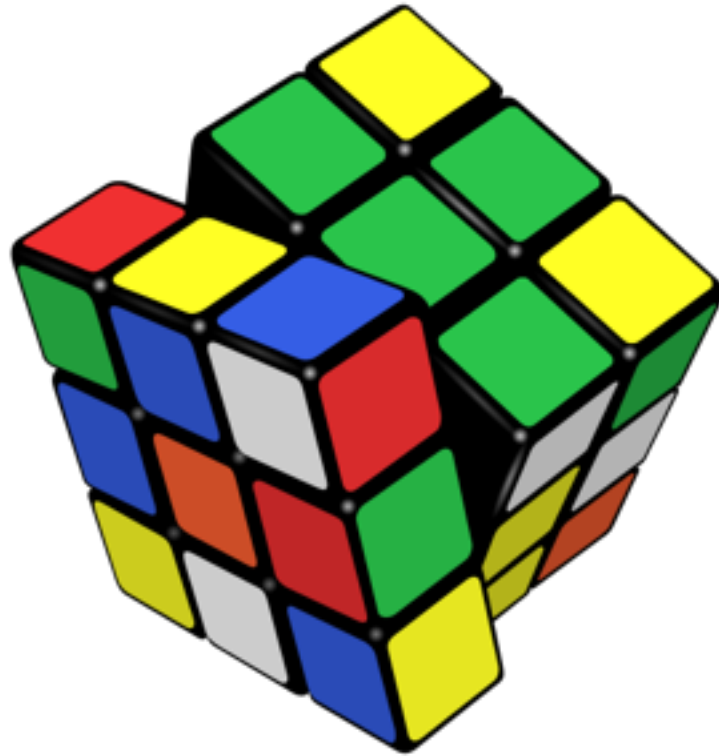
QUESTION

What does it take to make this jump?

ANSWER: PROBLEM SOLVING!

10





NOTE

Implementing solutions to ML problems is the focus of this course!

II. MACHINE LEARNING PROBLEMS

Features: “Columns” of your data. Generally are independent variables that cover some numerical space (either as a continuous set or itemized matrix)

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Algorithm: A “predetermined set of rules.” We will talk about a wide variety of algorithms throughout the next few weeks!

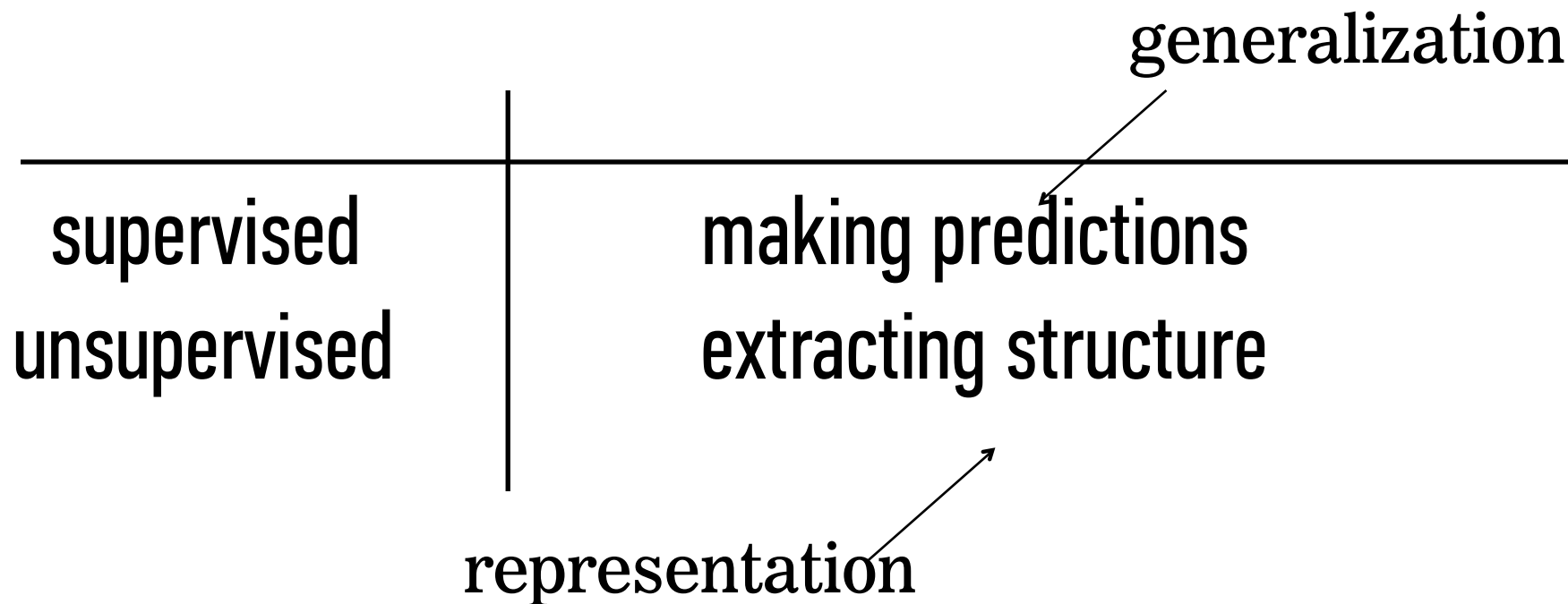
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Model = Algorithm + Features + Observations

supervised	making predictions
unsupervised	extracting structure



	continuous	categorical
	quantitative	qualitative

continuous

categorical

quantitative

qualitative

NOTE

The space where data live is called the feature space.

Each point in this space is called a record.

	continuous	categorical
supervised	regression	classification
unsupervised	dimension reduction	clustering

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NOTE

We will implement solutions using models and algorithms.

Each will fall into one of these four buckets.

QUESTION

**WHAT
IS THE
GOAL
OF
MACHINE LEARNING?**

supervised	making predictions
unsupervised	extracting structure

ANSWER

The goal is determined
by the type of problem.

QUESTION

**HOW
DO YOU
DETERMINE
THE RIGHT
APPROACH?**

	continuous	categorical
supervised	regression	classification
unsupervised	dimension reduction	clustering

ANSWER

The right approach is determined by the desired solution.

	continuous	categorical
supervised	regression	classification
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ANSWER

NOTE

The is d
des All of this depends on
your data!

QUESTION

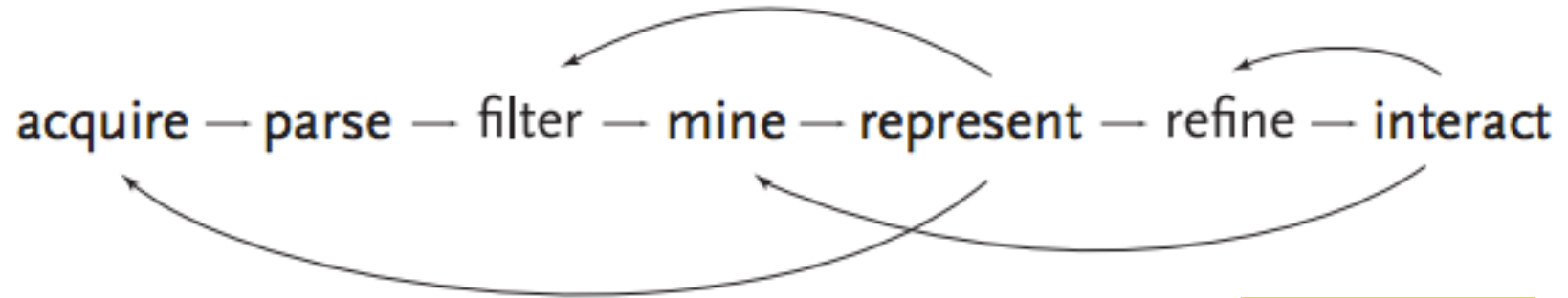
WHAT

DO YOU

DO

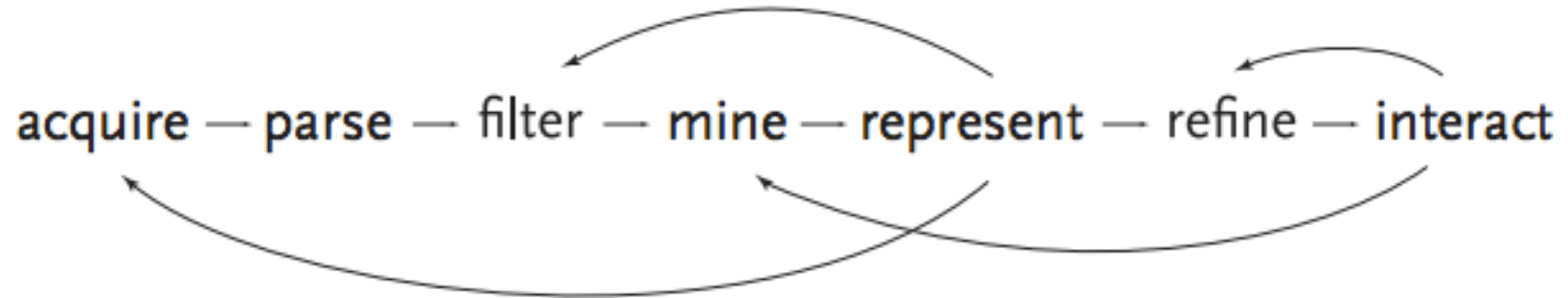
WITH YOUR

RESULTS?



ANSWER

Interpret them and react accordingly.



ANSWER

In
re **NOTE**

This also relies on your
problem solving skills!

III. 'CLASS'IFICATION ACTIVITY

One of the simplest machine learning algorithms is K-Nearest Neighbors (KNN for short)

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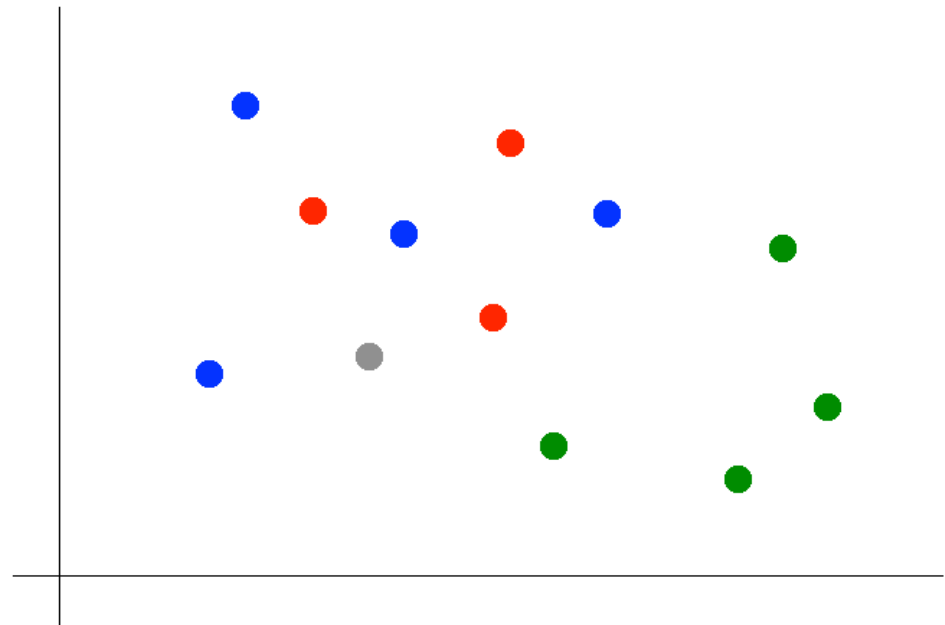
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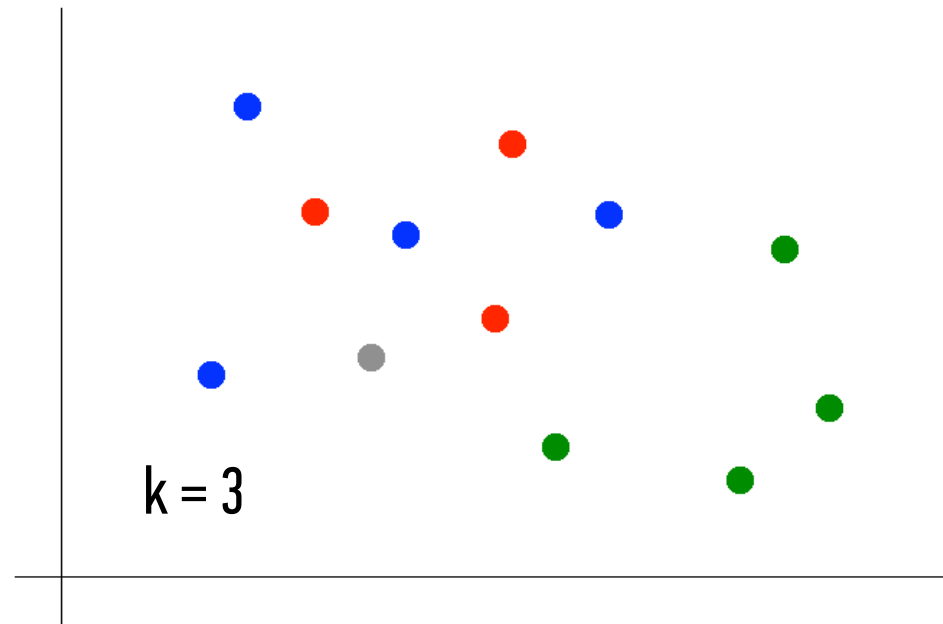
1. Pick an observation to predict a classification
2. Use a distance formula for neighbors k to find the nearest neighbors
3. Whichever neighbors have the highest representation of a class decide how to classify the unknown observation!

Suppose we want to predict the color of the grey dot.



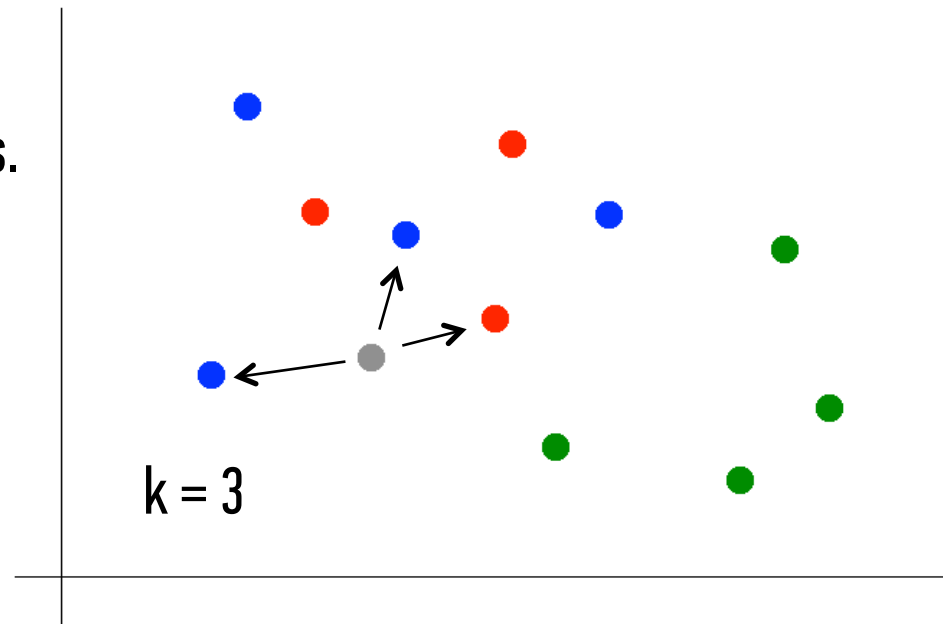
Suppose we want to predict the color of the grey dot.

1) Pick a value for k .



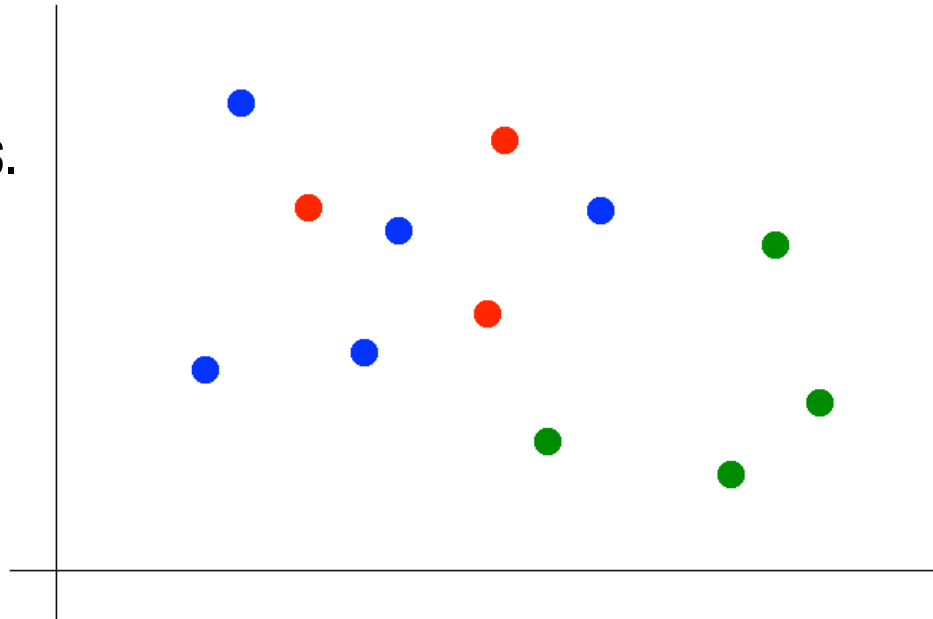
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- 2) Find colors of k nearest neighbors.



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- 2) Find colors of k nearest neighbors.
- 3) Assign the most common color to the grey dot.

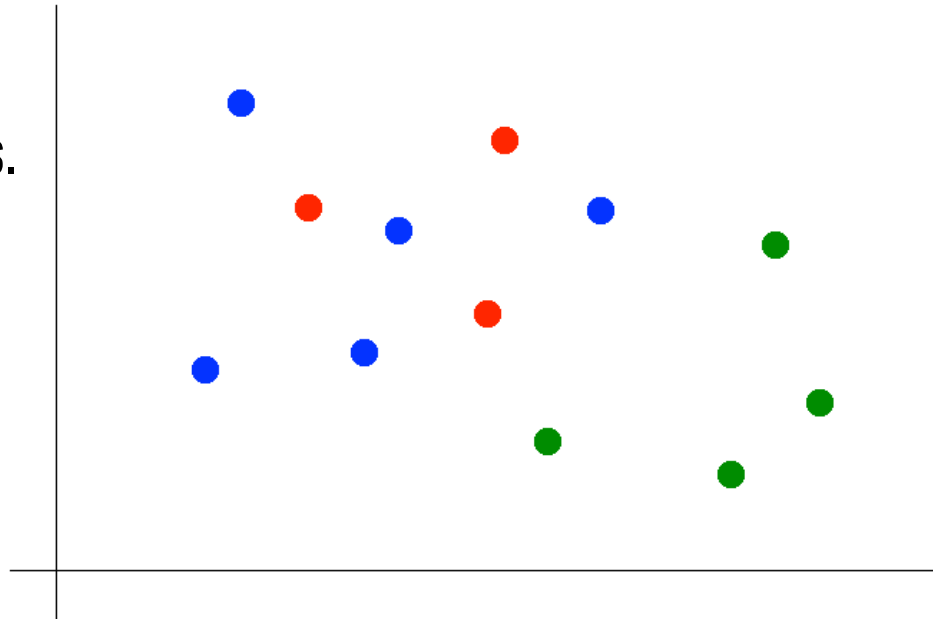


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OPTIONAL NOTE

Our definition of “nearest” implicitly uses the *Euclidean distance function*.



As a class, consider our values as a feature space with 3 features:

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1. On a scale of 1 to 10 (10 being most important), how important is it for you to work at a company where the product sells and brings in revenue? (continuous)
2. On a scale of 1 to 10 (10 being most important), how important is it for you to work at a company where the goal is to create an amazing product for everyone? (continuous)
3. Which region of the United States (or country) that you've spent the majority of your life.

Final thoughts/Reflection:

1. What worked well with that approach to classifying people?
2. What didn't work well with that approach to classifying people?
3. What other challenges could have come up with this approach?