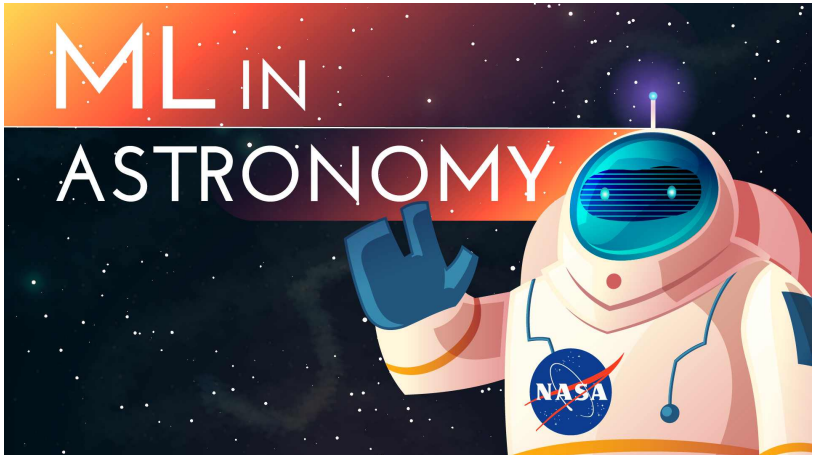


# Machine Learning in Astronomy

Reza Monadi

UC Riverside

May 14, 2020



credit: 365datascience.com

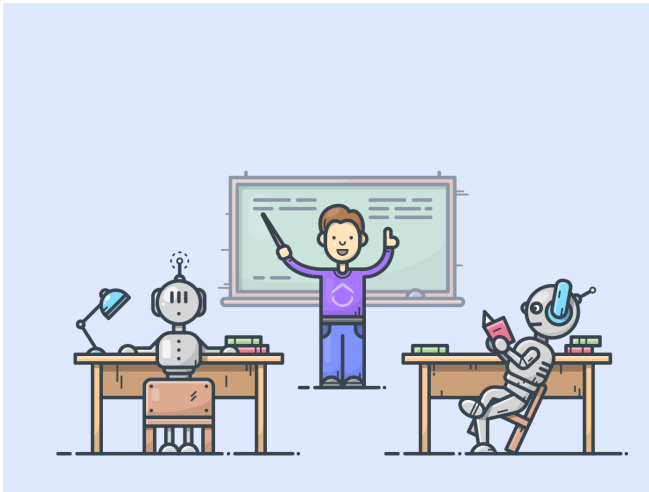
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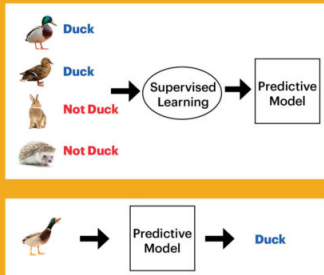
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- What are the pitfalls of **ML** in astronomy?

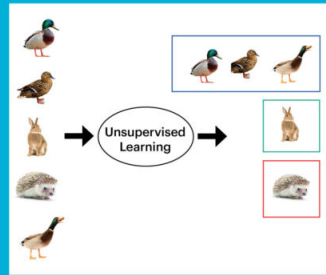




### Supervised Learning (Classification Algorithm)

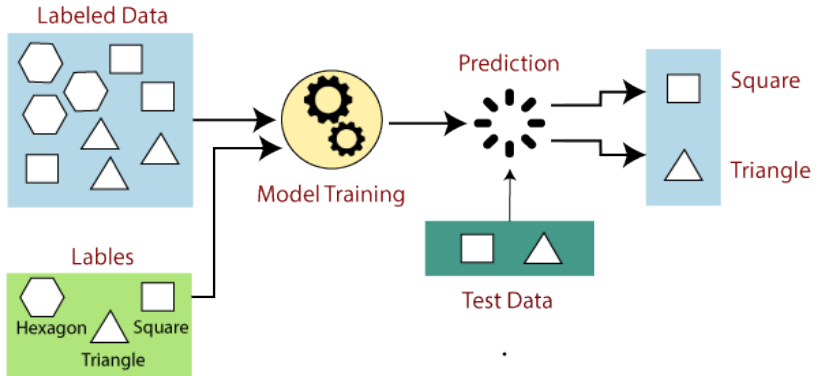


### Unsupervised Learning (Clustering Algorithm)



Western Digital.

# How supervised learning works?



credit: javatpoint.com

# Stages of Supervised Learning

- Training:

# Stages of Supervised Learning

- Training:
  - ① Select a model

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  - 1 Select a model
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  - 2 Select the optimum hyper-parameters
- Testing:
  - 1 Test learned model by an unseen part of the data-set.
  - 2 Select the best model and use it for predictions.

# Supervised Learning vs Traditional Model Fitting ?



## Similarities



# Supervised Learning vs Traditional Model Fitting ?



## Similarities

- Both need a set of labeled measurements

# Supervised Learning vs Traditional Model Fitting ?



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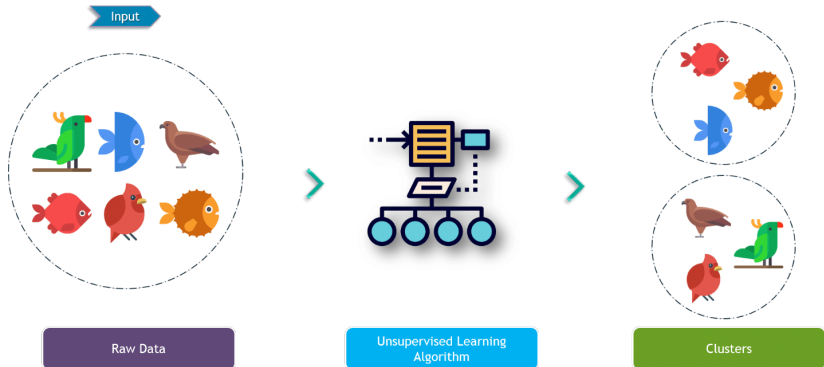
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## Differences

- Supervised learning:
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- Traditional model fitting:
  - 1 The model is predefined and has limited adaptivity
  - 2 Useful for inferring relationships between features

# How unsupervised learning works?





# Clustering

- KMeans:

# Clustering

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- DBSCAN:

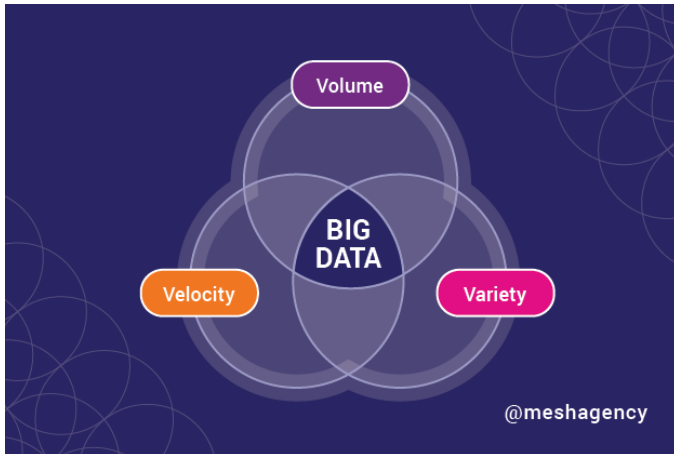
# Clustering

- KMeans:
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# Clustering

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- OPTICS:

# What is BIG DATA?



# VVV in astronomy

- Volume: larger quantities of data by better facilitates

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- Velocity: Higher speed of getting data

# VVV in astronomy

- Volume: larger quantities of data by better facilitates
- Velocity: Higher speed of getting data
- Verity: More complex structures of data



# Sloan Digital Sky Server

# Large Synaptic Survey Telescope

# Zwicky Transient Facility

# Gaia

# DESI

# Square Kilometer Array

# Astronomy $\Rightarrow$ BIG DATA $\Rightarrow$ ML

# List of Supervised learning algorithm used in astronomy?

- Classification: discrete targets
  - Spectrum: quasar, star, galaxy, supernova, ...
- Regression: continuous targets
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text



