Generative Modeling: On Mixtures

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Introduction to Machine Learning

CSCI-635

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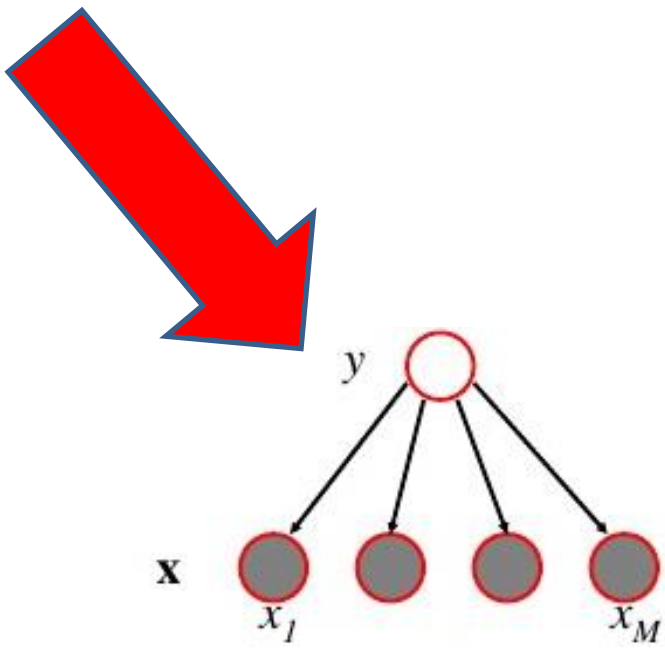
First, Some Naïve Bayes Wrap-up!

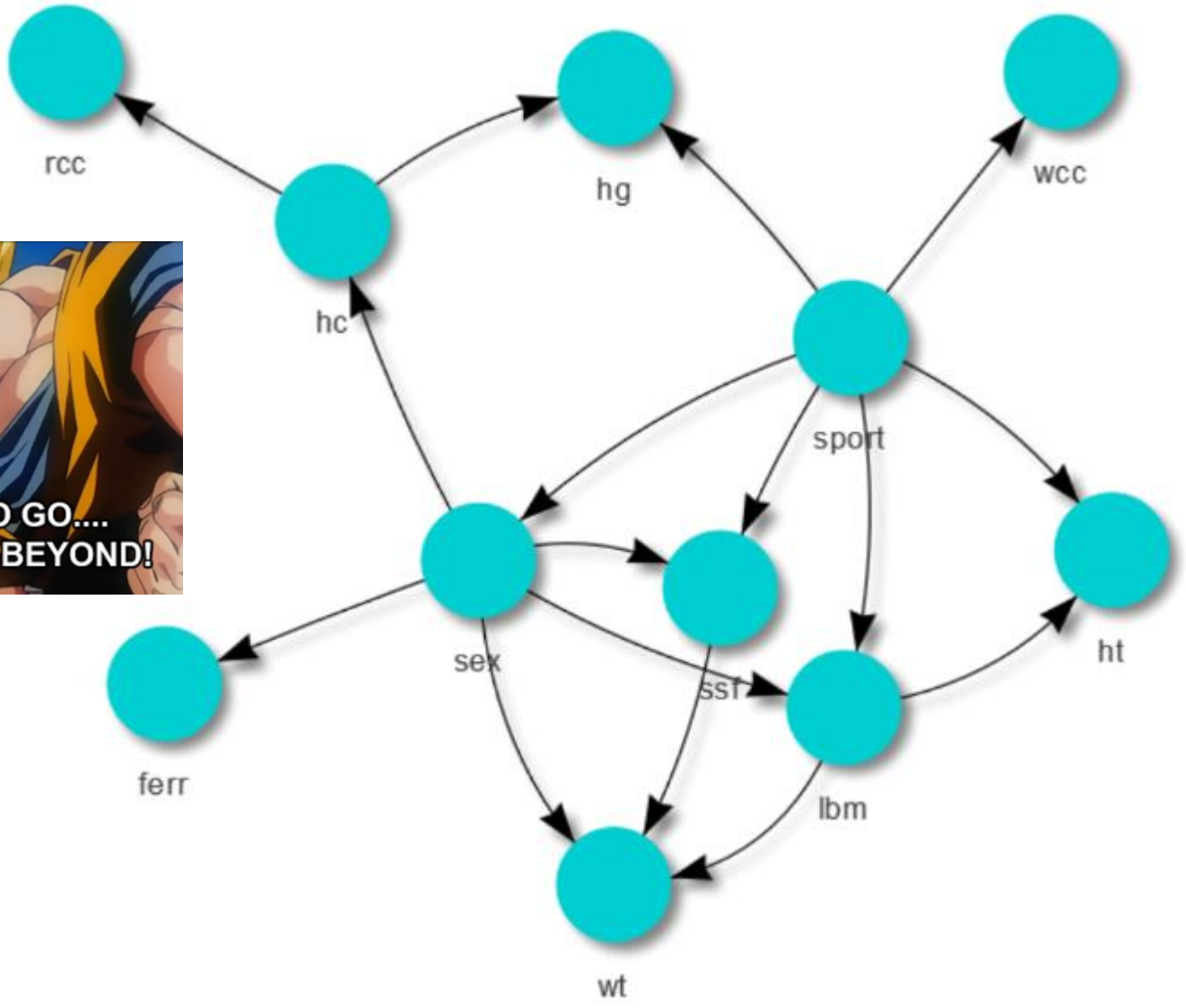
Class-Labeled Training Tuples from the *AllElectronics* Customer Database

RID	age	income	student	credit_rating	Class: buys_computer
1	youth	high	no	fair	no
2	youth	high	no	excellent	no
3	middle_aged	high	no	fair	yes
4	senior	medium	no	fair	yes
5	senior	low	yes	fair	yes
6	senior	low	yes	excellent	no
7	middle_aged	low	yes	excellent	yes
8	youth	medium	no	fair	no
9	youth	low	yes	fair	yes
10	senior	medium	yes	fair	yes
11	youth	medium	yes	excellent	yes
12	middle_aged	medium	no	excellent	yes
13	middle_aged	high	yes	fair	yes
14	senior	medium	no	excellent	no



White board time! Hand calculations of the Naïve Bayes model with Laplacian smoothing!

What would be beyond Naïve Bayes?
Answer: Bayesian Networks



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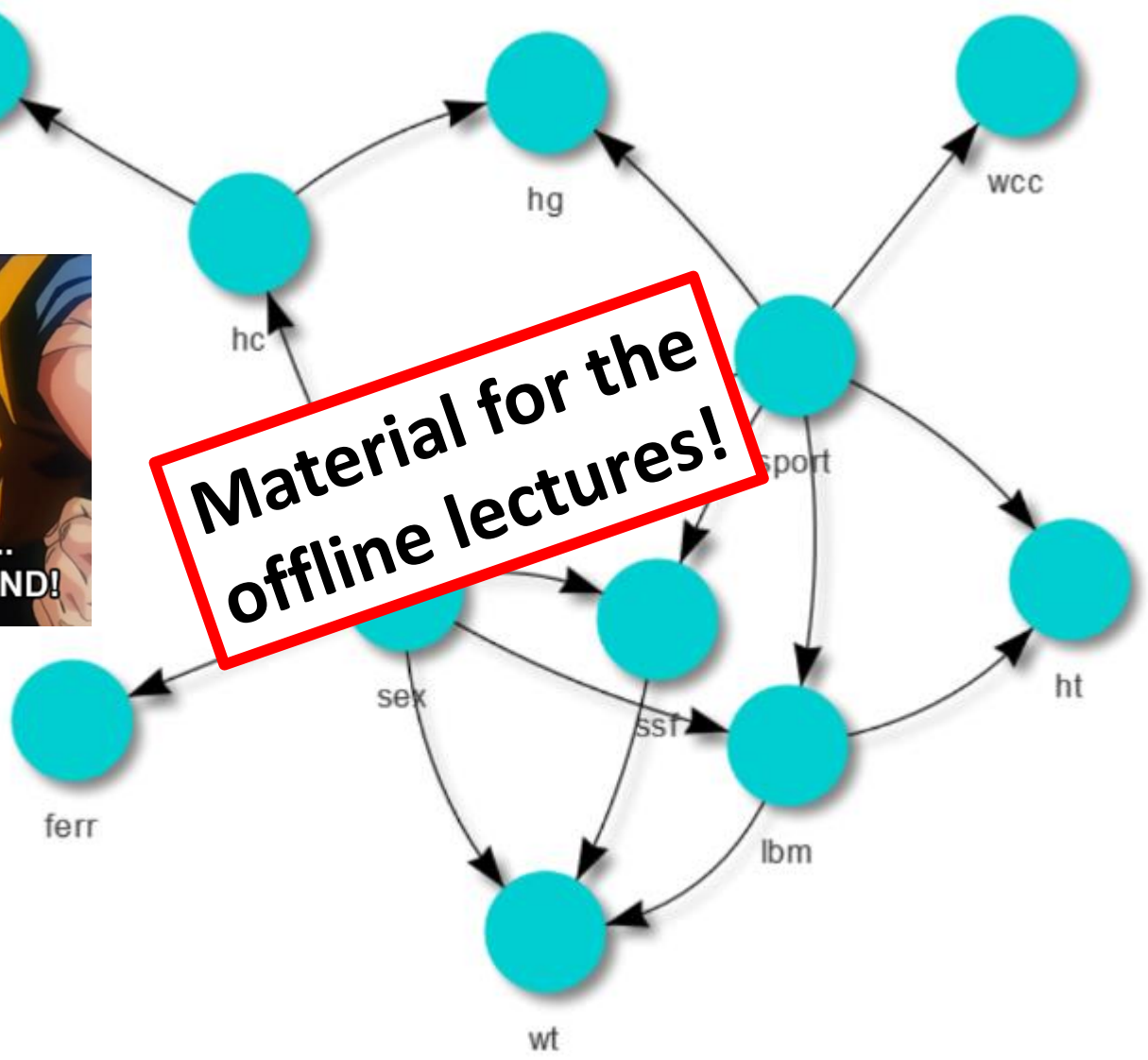


Material for the offline lectures!

What is a Generative Model?

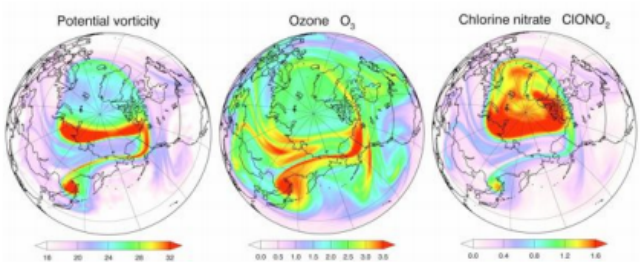
A model that allows us to learn a simulator of data

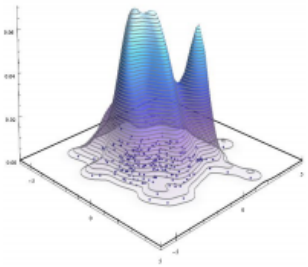
Models that allow for (conditional) density estimation

Approaches for unsupervised learning of data

Characteristics are:

- **Probabilistic** models of data that allow for uncertainty to be captured.
- **Data distribution p(x)** is targeted.
- **High-dimensiona**l outputs.





NO LABELS

Beyond Classification

Move beyond associating inputs to outputs

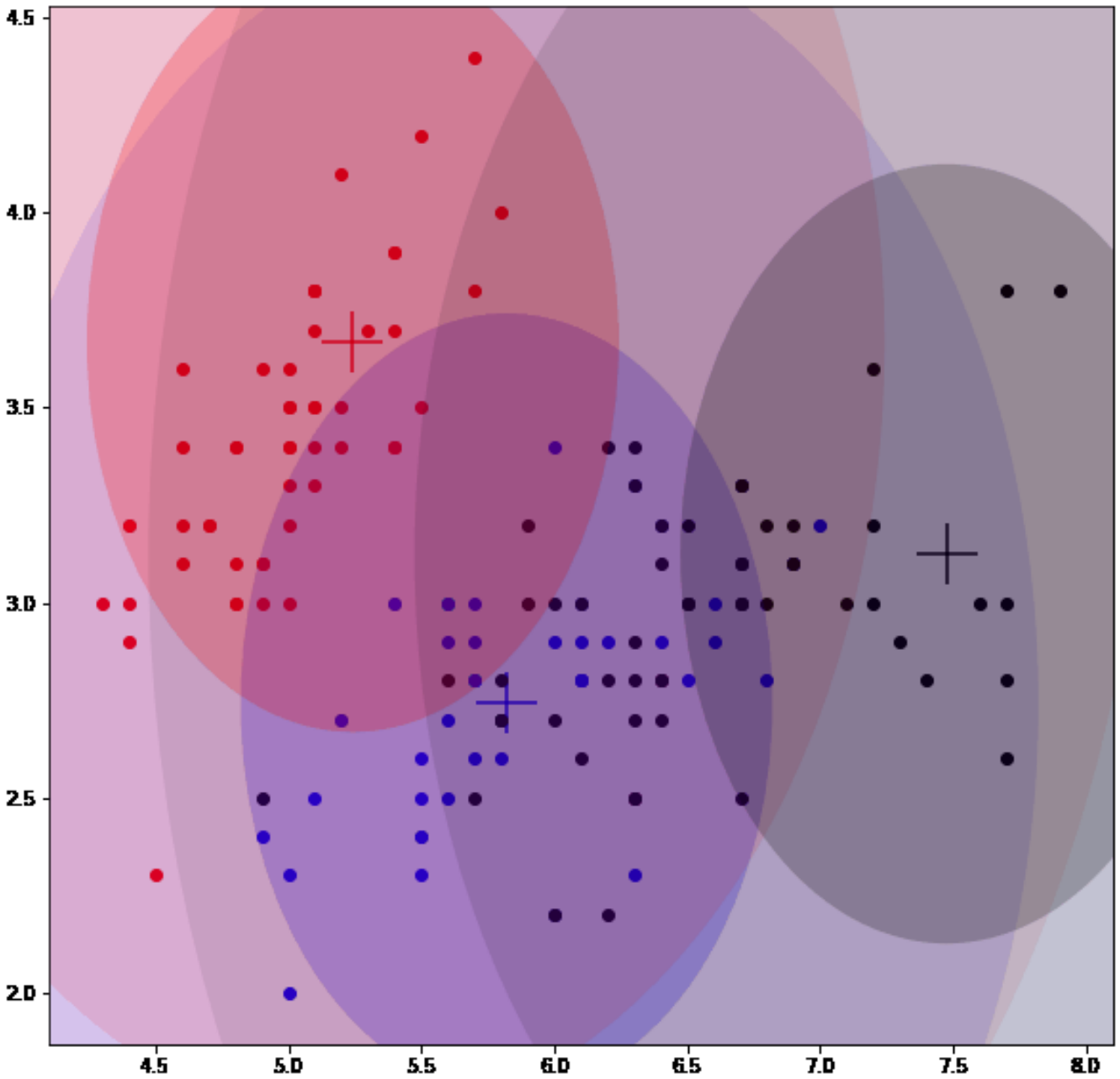
Understand and imagine how the world evolves

Recognise objects in the world and their factors of variation

Detect surprising events in the world

Establish concepts as useful for reasoning and decision making

Anticipate and generate rich plans for the future



Unsupervised Generative Modeling!

White board time! Deriving/crafting a mixture of Gaussians model

QUESTIONS?