

Lecture 14: 2 March, 2023

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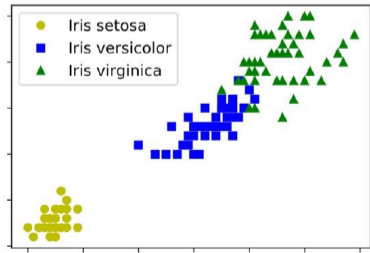
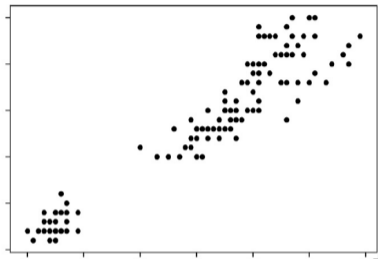
Data Mining and Machine Learning
January–May 2023

Unsupervised learning

- Supervised learning requires labelled data
- Vast majority of data is unlabelled
- What insights can you get into unlabelled data?

“If intelligence was a cake, unsupervised learning would be the cake, supervised learning would be the icing on the cake ...”

- Yann LeCun
ACM Turing Award 2018



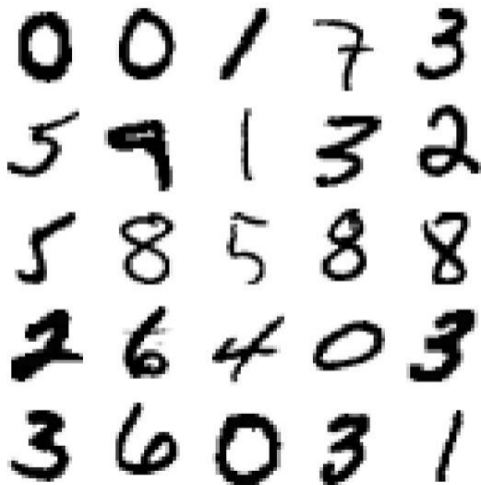
Applications

- Customer segmentation
 - Marketing campaigns
- Anomaly detection
 - Outliers
- Semi-supervised learning
 - Propagate limited labels
- Image segmentation
 - Object detection



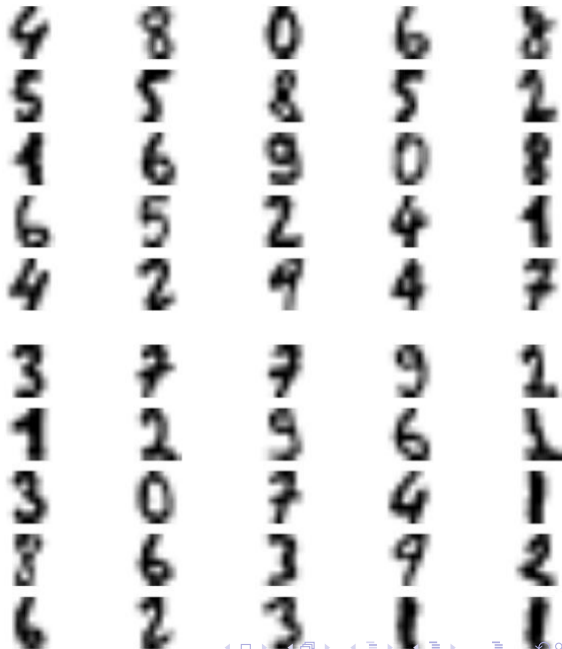
Semi-supervised learning

- Labelling training data is a bottleneck of supervised learning
- Handwritten digits 0,1,...,9
 - 1797 images
- Standard logistic regression model has 96.9% accuracy
- Suppose we take 50 random samples as training set
- Logistic regression gives 83.3%



Semi-supervised learning

- Instead of 50 random samples, 50 clusters using K means
- Use image nearest to each centroid as training set
 - 50 *representative images*
- Logistic regression accuracy jumps to 92.2%



Semi-supervised learning

- Propagate representative image label to entire cluster
- Logistic regression improves to 93.3%
- Propagage representative image label to only 20% items closest to centroid
- Logistic regression improves to 94%
- Only 50 actual labels used, about 5 per class!

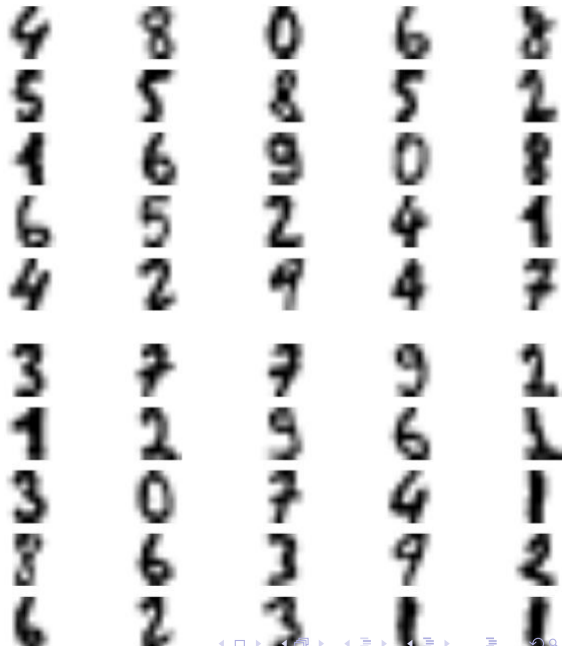


Image segmentation

- An image is a matrix of pixels
- Each pixel has (R,G,B) values
- K means clustering on these values merges colours



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- At 6 colours, ladybug red goes

6 colors



Image segmentation

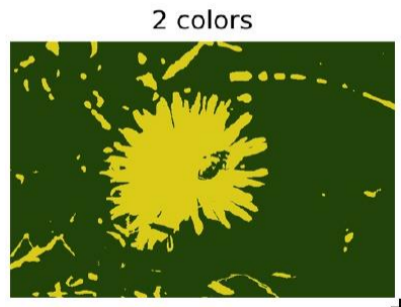
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- 4 colours

4 colors



Image segmentation

- An image is a matrix of pixels
- Each pixel has (R,G,B) values
- K means clustering on these values merges colours
- With 10 clusters, not much change
- Same with 8
- At 6 colours, ladybug red goes
- 4 colours
- Finally 2 colours, flower and rest



Summary

- Unsupervised learning is useful as a preprocessing step
- Semi supervised learning
 - Identify a small subset of items to label manually
 - Propagate labels via cluster
- Image segmentation
 - Highlight objects by colour

0 0 1 7 3
5 9 1 3 2
5 8 5 8 8
2 6 4 0 3
3 6 0 3 1

