



Intel·ligència Artificial aplicada a la construcció

Tema I: Intel·ligència artificial exemples Aplicació a la Construcció

La Inteligencia Artificial (o I.A.) es la capacidad de una **máquina** o **sistema informática** de emular en parte el comportamiento de la mente humana desarrollando capacidades que hasta hace poco solo estaban alcance del cerebro humano, como la creatividad o el análisis complejo en base de datos incompletos.

Arthur Samuel (1959). Machine Learning definition:
Field of study that gives computers the ability to learn
without being explicitly programmed.

Tom Mitchell (1998) Well-posed Learning Problem: A
computer program is said to learn from experience E with
respect to some task T and some performance measure P , if
its performance on T , as measured by P , improves
with experience E .

“A computer program is said to *learn* from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E.”

Suppose your email program watches which emails you do or do not mark as spam, and based on that learns how to better filter spam. What is the task T in this setting?

- ☒ Classifying emails as spam or not spam. T ←
- ☐ Watching you label emails as spam or not spam. E ←
- ☐ The number (or fraction) of emails correctly classified as spam/not spam.
- ☐ None of the above—this is not a machine learning problem. P ←

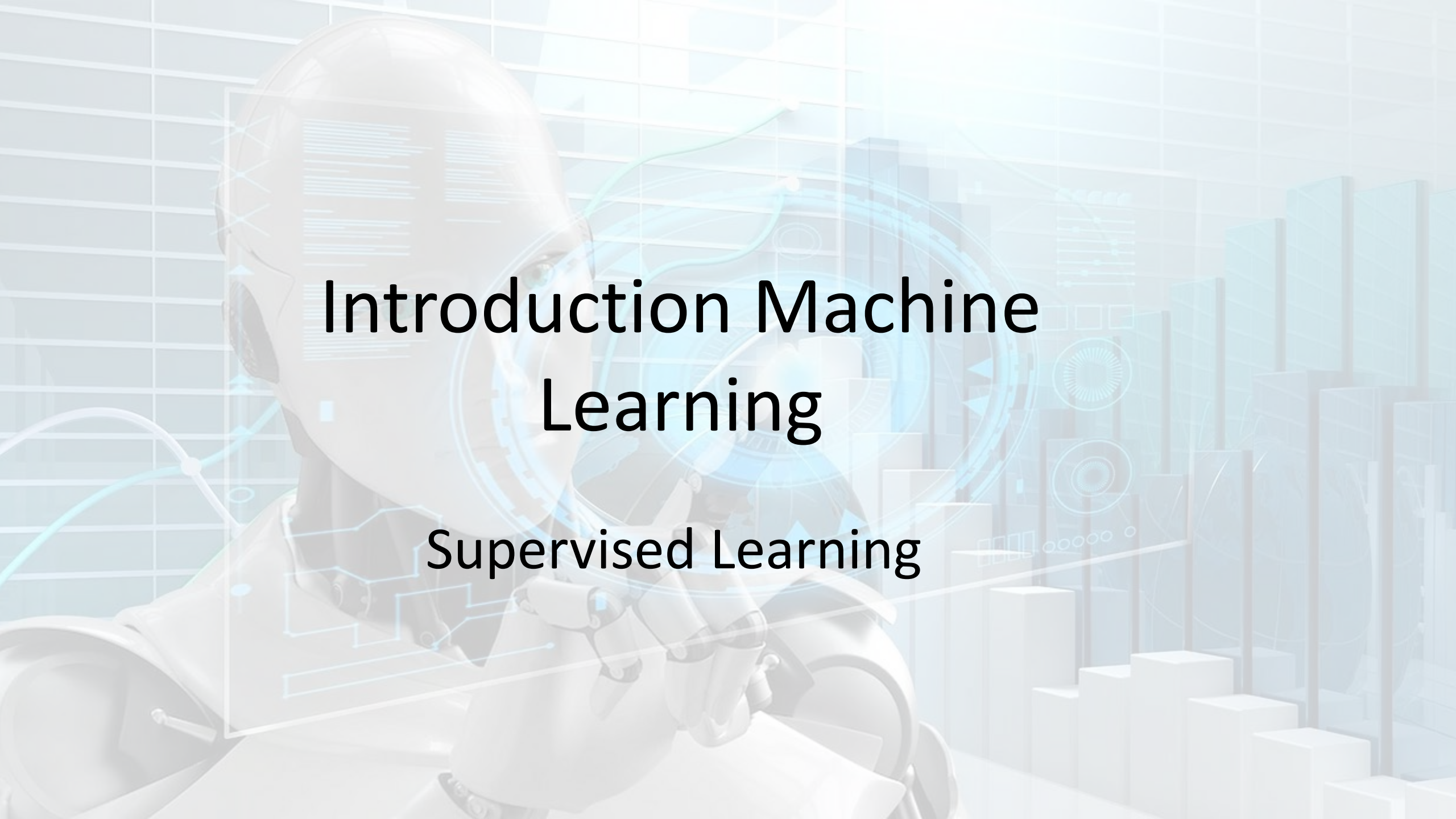
Machine learning algorithms:

- Supervised learning
 - Unsupervised learning
- 

Others: Reinforcement learning, recommender systems.

Also talk about: Practical advice for applying learning algorithms

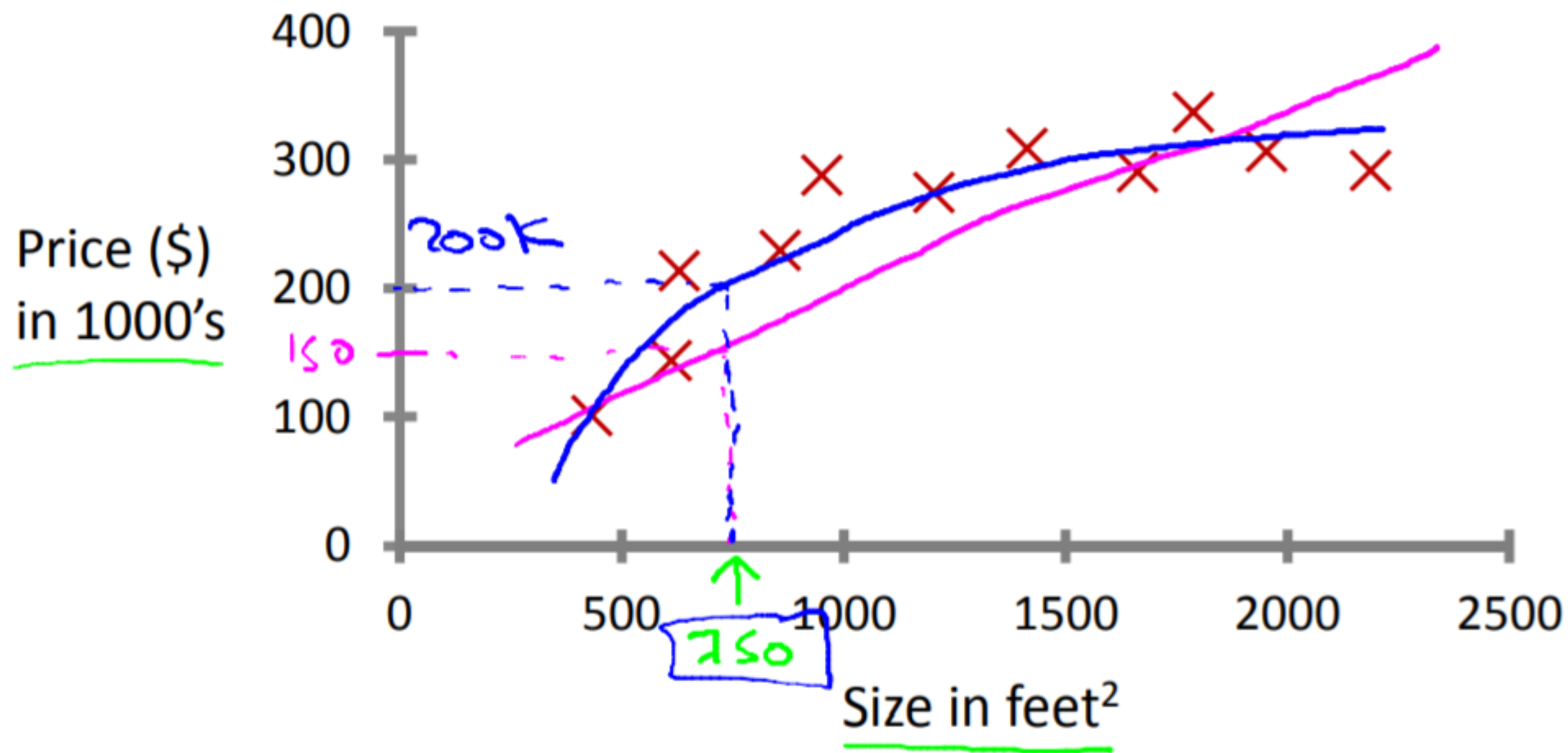




Introduction Machine Learning

Supervised Learning

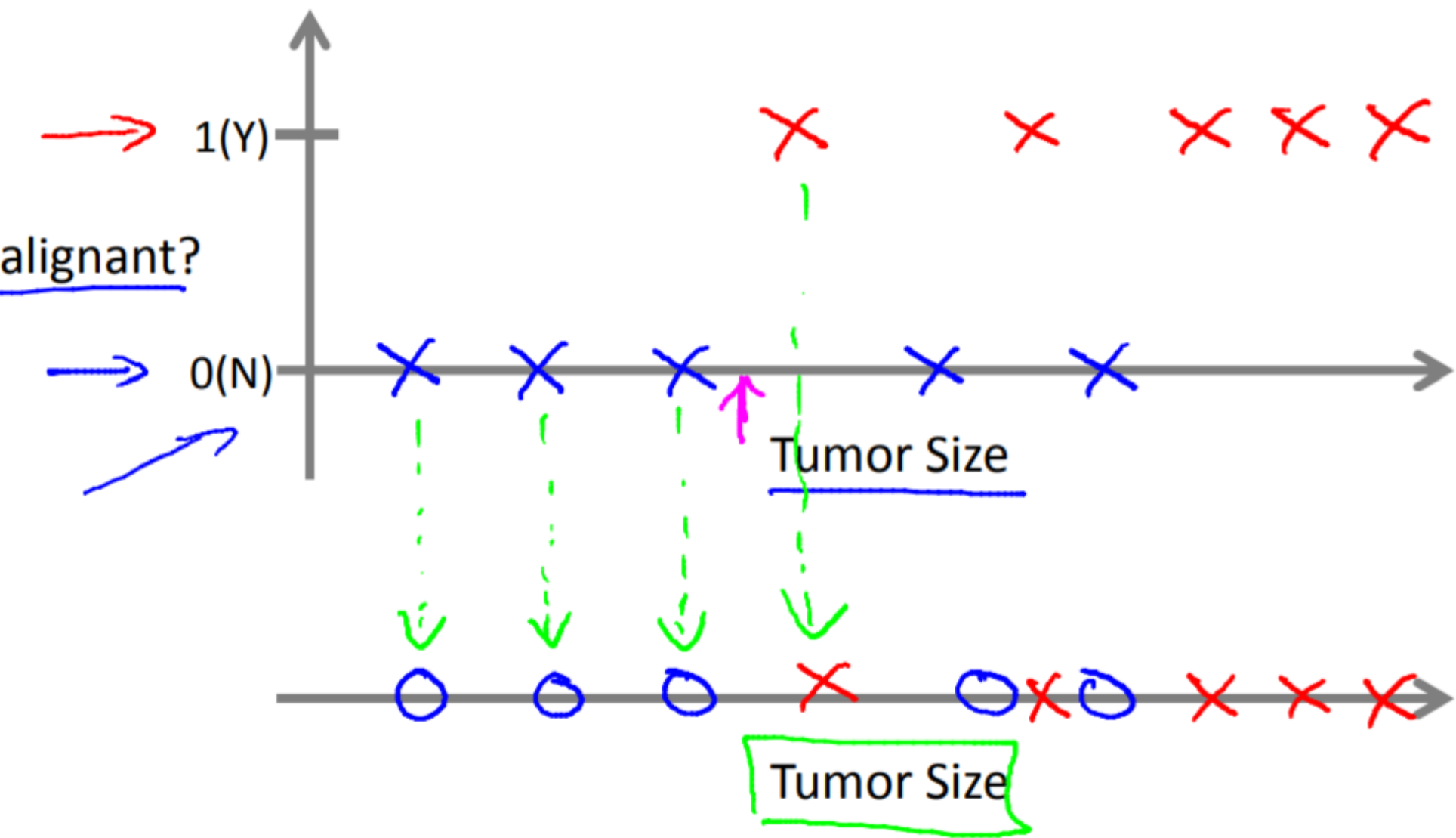
Housing price prediction.



Supervised Learning

Regression: Predict continuous

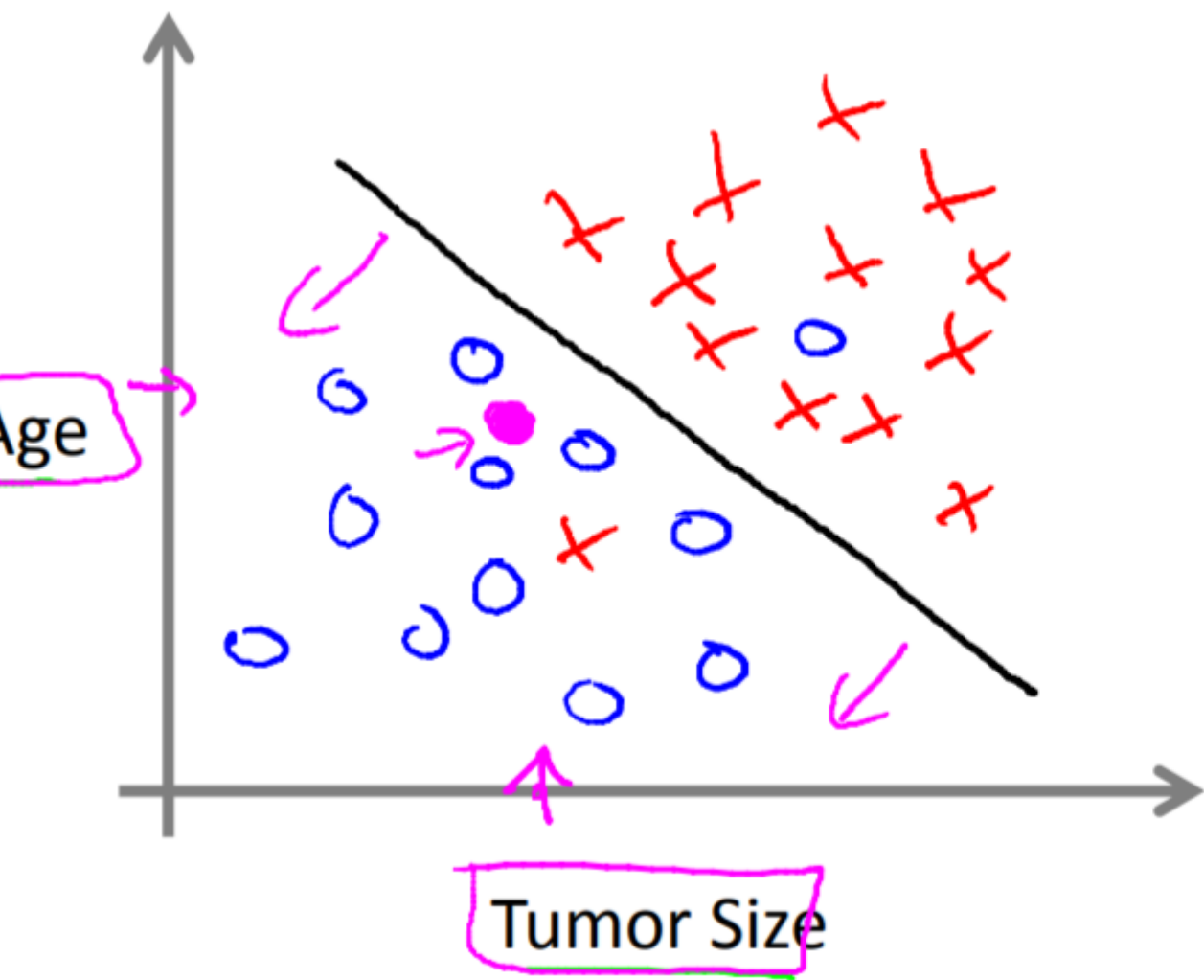
Breast cancer (malignant, benign)



Classification

Discrete values
output (0 or 1)

0, 1, 2, 3
↓
benign type 1
cancer



- Clump Thickness
 - Uniformity of Cell Size
 - Uniformity of Cell Shape
- ...

You're running a company, and you want to develop learning algorithms to address each of two problems.

1000's

Problem 1: You have a large inventory of identical items. You want to predict how many of these items will sell over the next 3 months.

Problem 2: You'd like software to examine individual customer accounts, and for each account decide if it has been hacked/compromised.

0 - not hacked
1 - hacked

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Problem 2: You'd like software to examine individual customer accounts, and for each account decide if it has been hacked/compromised.

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Should you treat these as classification or as regression problems?

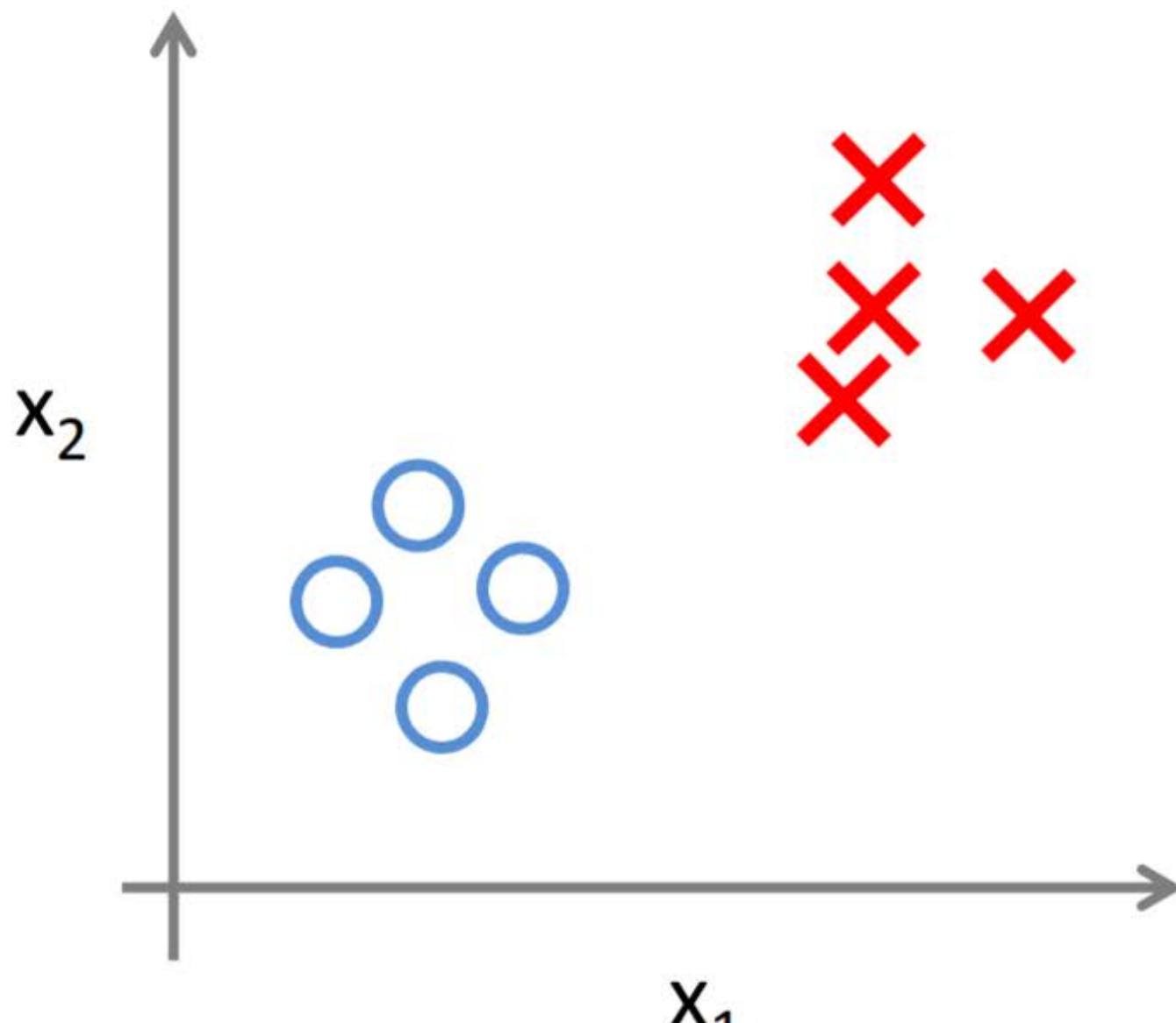
- ☐ Treat both as classification problems.
- ☐ Treat problem 1 as a classification problem, problem 2 as a regression problem.
- ☐ Treat problem 1 as a regression problem, problem 2 as a classification problem.
- ☐ Treat both as regression problems.



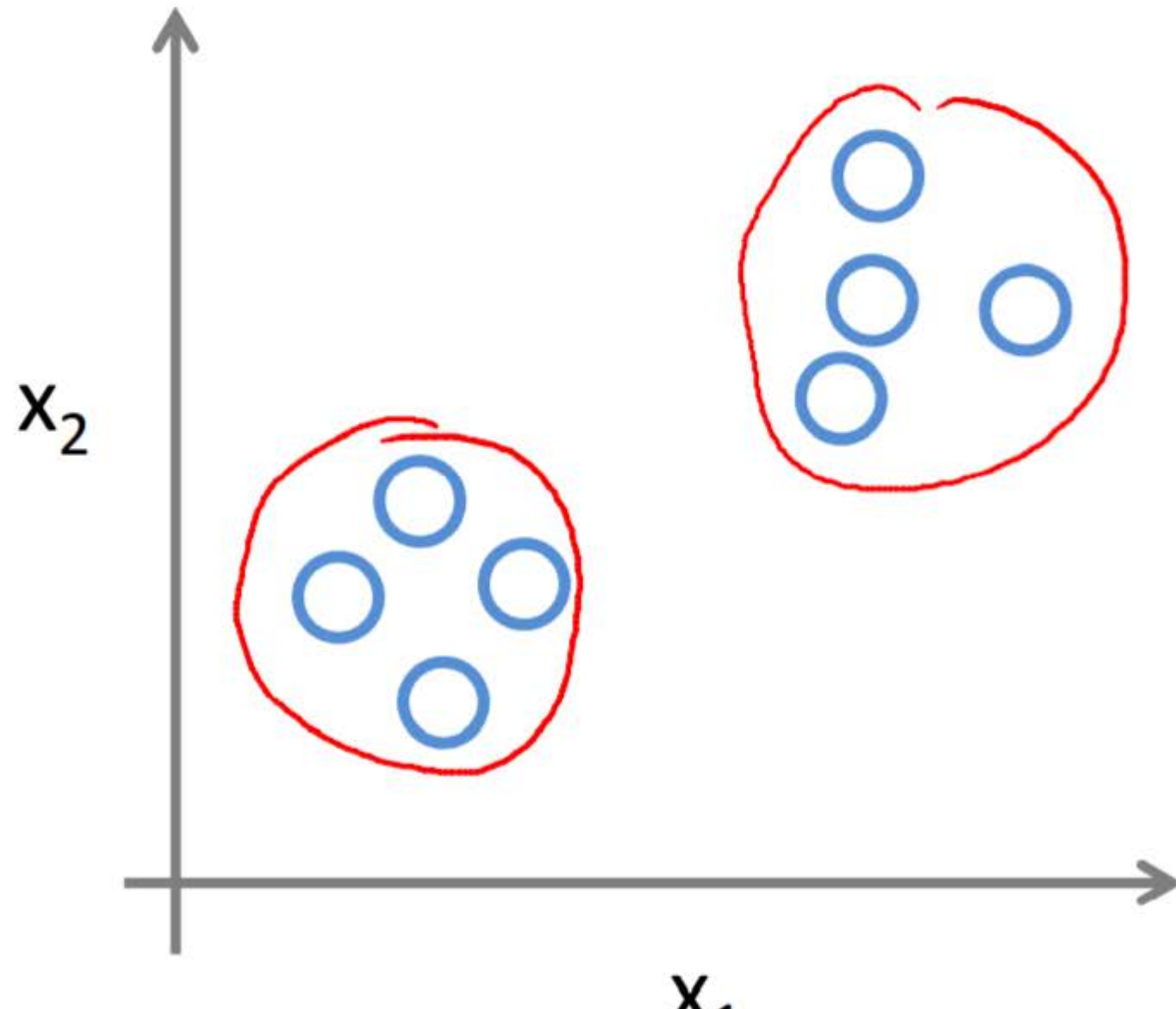
Introduction Machine Learning

Unsupervised Learning: Clustering

Supervised Learning



Unsupervised Learning





She knows and identifies this dog. Few weeks later a family friend brings along a dog and tries to play with the baby.



Baby has not seen this dog earlier. But it recognizes many features (2 ears, eyes, walking on 4 legs) are like her pet dog. She identifies the new animal as a dog. This is unsupervised learning, where you are not taught but you learn from the data (in this case data about a dog.) Had this been supervised learning, the family friend would have told the baby that it's a dog.

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SEPTEMBER 22, 2010, 10:44 PM GMT

BP Kills Macondo, But Its Legacy Lives On

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By James Heinen

BP confirmed late Sunday that the Macondo well that leaked almost five million barrels of oil into the Gulf of Mexico has been permanently sealed, but the well will continue to affect BP and the wider oil industry for many years.

The most immediate worry for BP and its shareholders is how the authorities will apportion blame for the spill. BP's own investigation swept numerous other



Fire blast response crews battled the blazing remnants of the off shore oil well Macondo on Sunday.

Published Photo

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The Source is WSJ.com Europe's home for rapid-fire analysis of the day's big business and finance stories. It is edited by Lauren Webb, based in London.

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By the CNN Wire Staff
 September 20, 2010 - Updated 12:17 GMT (2:17 AMT)



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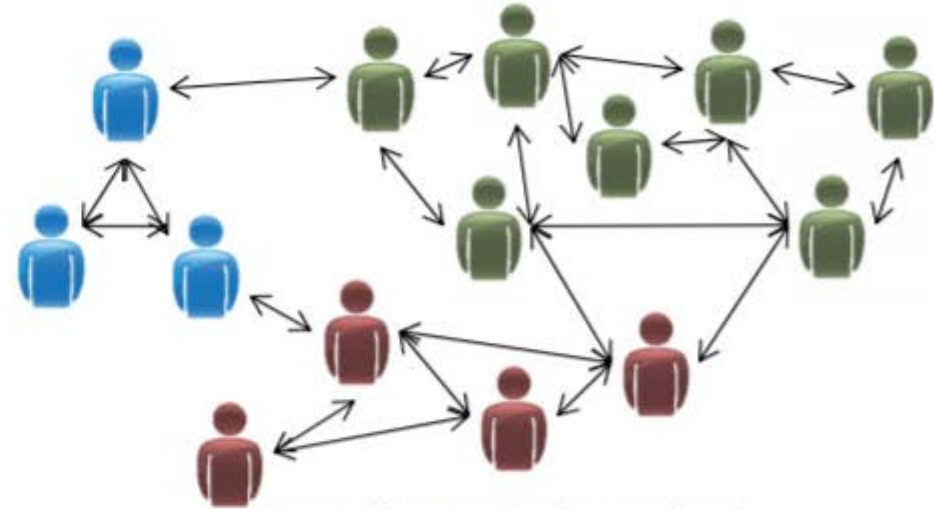
BP has set up a \$20bn compensation fund after the Deepwater Horizon disaster, which has so far paid out 19,000 claims totalling more than \$240m.

Julia Kolbe
 guardian.co.uk, Monday 20 September 2010 08:33 BST
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Organize computing clusters



Social network analysis

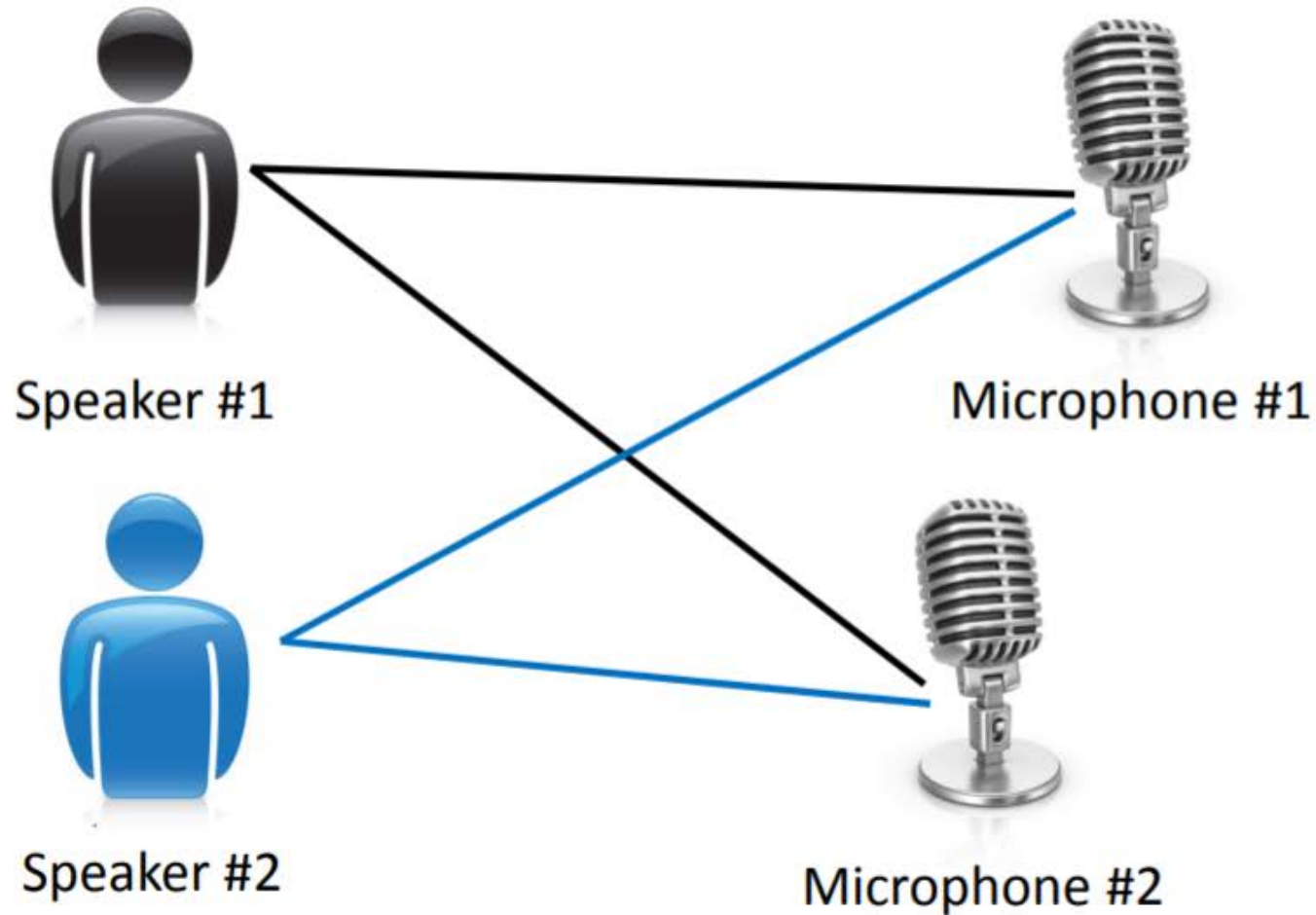


Market segmentation



Astronomical data analysis

Cocktail party problem



Cocktail party problem algorithm

```
[W,s,v] = svd((repmat(sum(x.*x,1),size(x,1),1).*x)*x');
```

[Source: Sam Roweis, Yair Weiss & Eero Simoncelli]

Of the following examples, which would you address using an unsupervised learning algorithm? (Check all that apply.)

- ☐ Given email labeled as spam/not spam, learn a spam filter.
- ☐ Given a set of news articles found on the web, group them into set of articles about the same story.
- ☐ Given a database of customer data, automatically discover market segments and group customers into different market segments.
- ☐ Given a dataset of patients diagnosed as either having diabetes or not, learn to classify new patients as having diabetes or not.

Examples of Machine Learning and Artificial Intelligence

<http://informesdelaconstruccion.revistas.csic.es/recursos.biblioteca.upc.edu/index.php/informesdelaconstruccion/article/view/5824/6759>

Ética

<https://venturebeat.com/2020/08/23/the-term-ethical-ai-is-finally-starting-to-mean-something/>

<https://azati.ai/artificial-intelligence-in-building-and-construction/>

<http://salineropampliega.com/2019/09/inteligencia-artificial-en-la-gestion-de-proyectos-de-construccion.html>

<https://emerj.com/ai-sector-overviews/ai-building-automation-current-applications/>

[www.seiscubos.com](http://www.seiscubos.com/%2Fconocimiento%2Foptimizacion-genetica)%2Fconocimiento%2Foptimizacion-genetica

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<https://ec.europa.eu/futurium/en/ai-alliance-consultation/guidelines>

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%Matlab

<https://es.mathworks.com/help/deeplearning/ref/feedforwardnet.html>

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Descripció:

Diagnòstic de patologies.

Valoració d'immobles.

Eficiència energètica.

Estimació de costos de construcció.

Objectius específics:

Donar a conèixer, a través d'exemples, aplicacions de la intel·ligència artificial en l'àmbit de la construcció.

Activitats vinculades:

Lectura d'articles especialitzats i presentació oral.

Dedicació: 25h

Grup gran/Teoria: 4h

Grup mitjà/Pràctiques: 6h

Aprenentatge autònom: 15h

Bàsica:

- J. M. Núñez Tabales, F. J. Rey Carmona, J. M. Caridad y Ocerin. "Redes neuronales (RN) aplicadas a la valoración de locales comerciales". Informes de la Construcción [en línea]. <http://dx.doi.org/10.3989/ic.15.053%20Disponible> a: <http://dx.doi.org/10.3989/ic.15.053%20>.
- J.F. Coloma, L.F. Valverde, M. García. "Estimación de los costes de construcción de viviendas rústicas mediante Redes Neuronales Artificiales". Informes de la Construcción [en línea]. <https://doi.org/10.3989/ic.62206Disponible> a: <https://doi.org/10.3989/ic.62206>.
- J. A. Chávez-Hernández, C. A. Recarey, M. M. García-Lorenzo, O. López-Jiménez. "Utilización de la Inteligencia Artificial en el diagnóstico patológico de edificaciones de valor patrimonial". Informes de la Construcción [en línea]. doi: 10.3989/ic.11.036Disponible a: doi: 10.3989/ic.11.036.
- M.U. Mehmood, D. Chun, Zeeshan, H. Han, G. Jeon, K. Chen. "A review of the applications of artificial intelligence and big data to buildings for energy-efficiency and a comfortable indoor living environment". Energy & Buildings [en línea]. <https://doi.org/10.1016/j.enbuild.2019.109383Disponible> a: <https://doi.org/10.1016/j.enbuild.2019.109383>.
- Carlos J. Pampliega. "Inteligencia artificial en el sector de la construcción". Building & Management, Gestión en Edificación [en línea]. http://polired.upm.es/index.php/building_managementDisponible a: http://polired.upm.es/index.php/building_management.
- Rainieri C, Fabbrocino G.. Operational Modal Analysis of Civil Engineering Structures. [en línea]. Springer, 2014Disponible a: <https://www.springer.com/gp/book/9781493907663>. ISBN 978-1-4939-4561-0.
- Pedro Ponce Cruz. Inteligencia artificial con aplicaciones a la ingeniería [en línea]. Alfaomega Grupo Editorial, 2015Disponible a: http://libroweb.alfaomega.com.mx/book/inteligencia_artificial_con_aplicaciones_a_la_ingenieria. ISBN 978-607-7854-83-8.
- Brincker R, Ventura CE. Introduction to Operational Modal Analysis [en línea]. Wiley, 2015Disponible a: <https://www.wiley.com/en-us/Introduction+to+Operational+Modal+Analysis-p-9781119963158>. ISBN 978-1-119-96315-8.