



Artificial Intelligence, This Unknown

Fabio Palomba
Assistant Professor
Software Engineering (SeSa) Lab
University of Salerno

fpalomba@unisa.it
[@fabiopalomba3](https://twitter.com/fabiopalomba3)
<https://fpalomba.github.io>



Artificial Intelligence, everywhere

Nowadays, AI is at the basis of every software we use



Music



Video



Movies



Books



Ads



Finance



Health



Education



Agriculture

...

Artificial Intelligence, everywhere

Nowadays, AI is at the basis of every software we use



Music



Video



Movies



Books



Ads



Finance



Health



Education



Agriculture

...

AI makes systems able to *adapt* themselves to the surrounding environment and to users, that's why it is becoming so pervasive!

Artificial Intelligence, everywhere

Nowadays, AI is at the basis of every software we use



Music



Video



Movies



Books



Ads



Finance



Health



Education



Agriculture

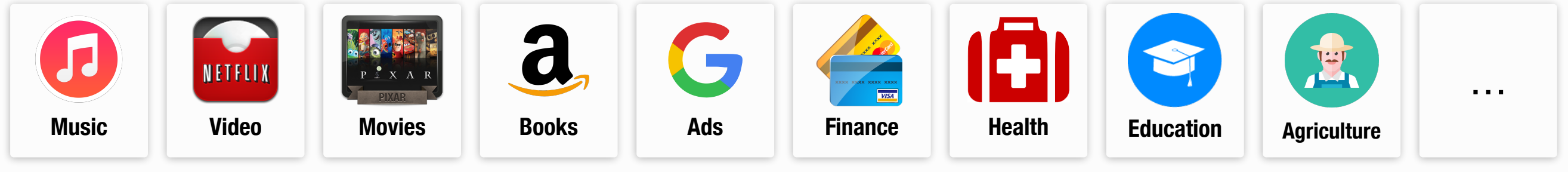
...

AI makes systems able to *adapt* themselves to the surrounding environment and to users, that's why it is becoming so pervasive!

This allows designers to empower their systems with smart functionalities that ease user's life. Let's just consider the case of Google Maps.

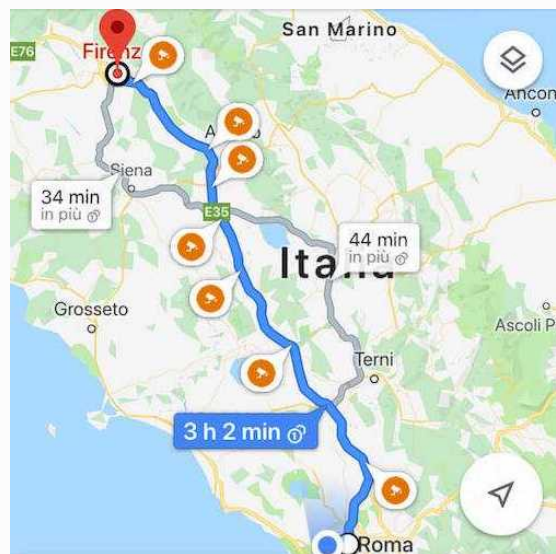
Artificial Intelligence, everywhere

Nowadays, AI is at the basis of every software we use



AI makes systems able to *adapt* themselves to the surrounding environment and to users, that's why it is becoming so pervasive!

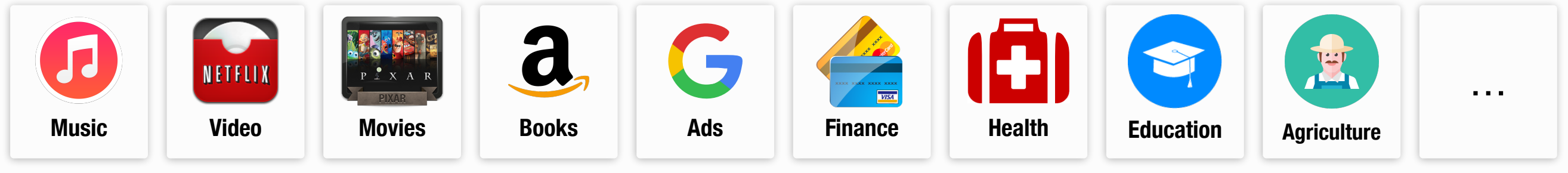
This allows designers to empower their systems with smart functionalities that ease user's life. Let's just consider the case of Google Maps.



2005
Google Maps and
alternative paths

Artificial Intelligence, everywhere

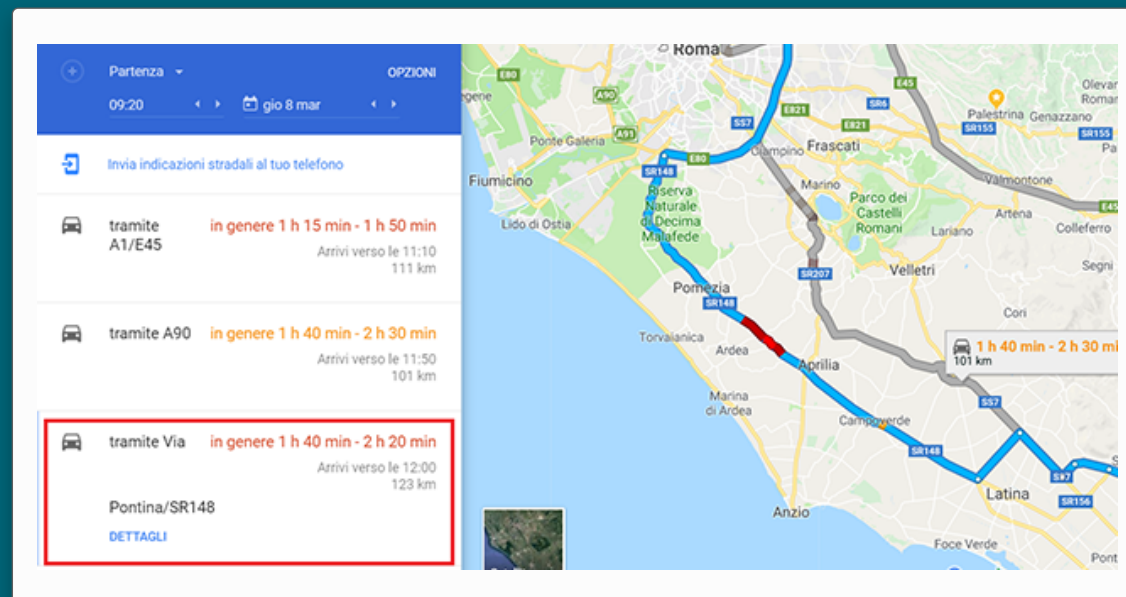
Nowadays, AI is at the basis of every software we use



AI makes systems able to *adapt* themselves to the surrounding environment and to users, that's why it is becoming so pervasive!

This allows designers to empower their systems with smart functionalities that ease user's life. Let's just consider the case of Google Maps.

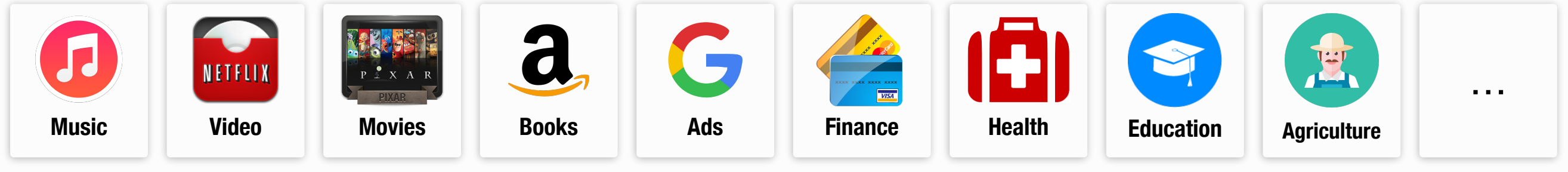
Google Maps and alternative paths



2017
Google Maps and alternative paths with real-time traffic information

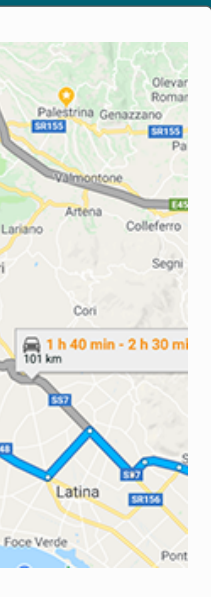
Artificial Intelligence, everywhere

Nowadays, AI is at the basis of every software we use



AI makes systems able to *adapt* themselves to the surrounding environment and to users, that's why it is becoming so pervasive!

This allows designers to empower their systems with smart functionalities that ease user's life. Let's just consider the case of Google Maps.



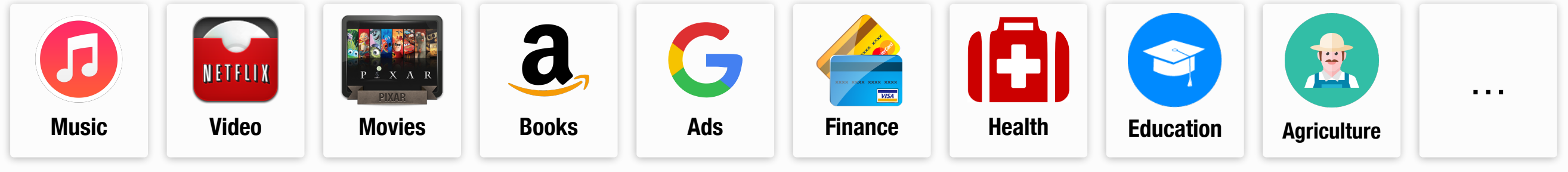
2017
Google Maps and alternative paths with real-time traffic information



Ability to plan smart departures

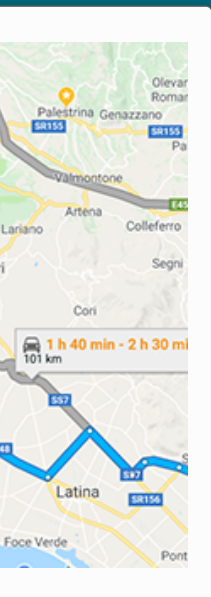
Artificial Intelligence, everywhere

Nowadays, AI is at the basis of every software we use



AI makes systems able to *adapt* themselves to the surrounding environment and to users, that's why it is becoming so pervasive!

This allows designers to empower their systems with smart functionalities that ease user's life. Let's just consider the case of Google Maps.



2017
Google Maps and alternative paths with real-time traffic information



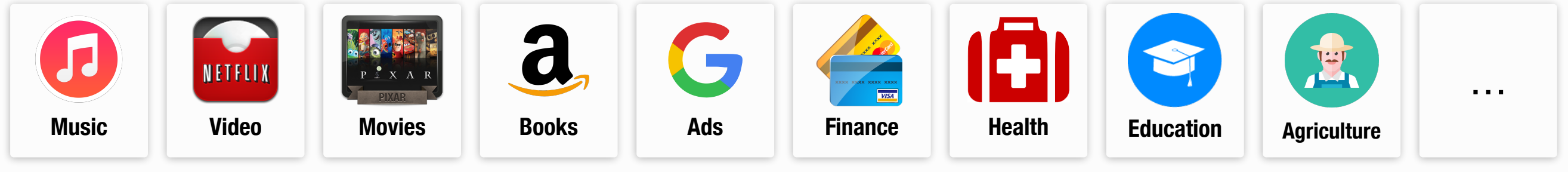
Ability to plan smart departures



Optimization of the traffic network

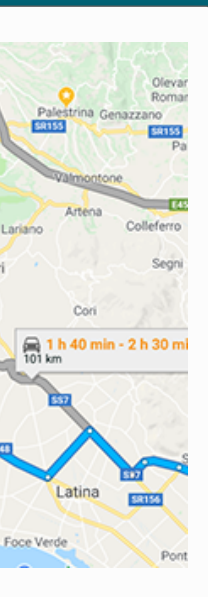
Artificial Intelligence, everywhere

Nowadays, AI is at the basis of every software we use



AI makes systems able to *adapt* themselves to the surrounding environment and to users, that's why it is becoming so pervasive!

This allows designers to empower their systems with smart functionalities that ease user's life. Let's just consider the case of Google Maps.



2017
Google Maps and alternative
paths with real-time traffic
information



Ability to plan smart departures



Optimization of the traffic network



Decision making and path optimization

Artificial Intelligence, this unknown

Despite its popularity and the tremendous impact it will have on society in the near future, most of us use artificial intelligence in a *passive* way, as a user of some magic box that in the end provides something potentially useful.



Artificial Intelligence, this unknown

Despite its popularity and the tremendous impact it will have on society in the near future, most of us use artificial intelligence in a *passive* way, as a user of some magic box that in the end provides something potentially useful.

First, AI has a **love relationship** with psychology and cognitive science, before being something mathematical.



Artificial Intelligence, this unknown

Despite its popularity and the tremendous impact it will have on society in the near future, most of us use artificial intelligence in a *passive* way, as a user of some magic box that in the end provides something potentially useful.

First, AI has a **love relationship** with psychology and cognitive science, before being something mathematical.

AI is “simply” based on the concept of **intelligent agent**. In 1943, Kenneth Craik - in his well-known book “*The Nature of Explanation*” - defined an intelligence agent as:

“*An organism able to act upon information it perceives and make decisions based on experience*”.



Artificial Intelligence, this unknown

Despite its popularity and the tremendous impact it will have on society in the near future, most of us use artificial intelligence in a *passive* way, as a user of some magic box that in the end provides something potentially useful.

First, AI has a **love relationship** with psychology and cognitive science, before being something mathematical.

AI is “simply” based on the concept of **intelligent agent**. In 1943, Kenneth Craik - in his well-known book “*The Nature of Explanation*” - defined an intelligence agent as:

“*An organism able to act upon information it perceives and make decisions based on experience*”.

Some years later, in 1950, the concept of **artificial** intelligence was formalized by Alan Turing through the *Imitation Game*.



Artificial Intelligence, this unknown

Despite its popularity and the tremendous impact it will have on society in the near future, most of us use artificial intelligence in a *passive* way, as a user of some magic box that in the end provides something potentially useful.

First, AI has a **love relationship** with psychology and cognitive science, before being something mathematical.

AI is “simply” based on the concept of **intelligent agent**. In 1943, Kenneth Craik - in his well-known book “*The Nature of Explanation*” - defined an intelligence agent as:

“*An organism able to act upon information it perceives and make decisions based on experience*”.

Some years later, in 1950, the concept of **artificial** intelligence was formalized by Alan Turing through the *Imitation Game*.

Nowadays, we associate four characteristics to intelligent agents: the abilities of (1) thinking *humanly*, (2) thinking *rationally*, (3) acting *humanly*, and (4) acting *rationally*.



Artificial Intelligence, behind the scenes

Weak

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.

Artificial Intelligence, behind the scenes

Weak

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.



search-based
algorithms

AI is used to *search and optimize solutions* to problems

Can I optimize the allocation of resources?

Can I manage water resources as a game?

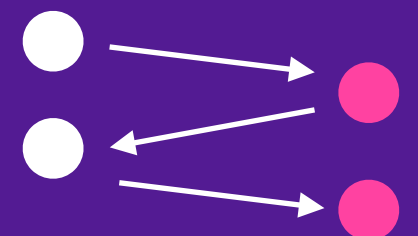
How can I place buildings to respect all constraints?

What is the quickest path given the current traffic data?

Genetic Algorithms



Game Theory



Constraints Satisfaction



Artificial Intelligence, behind the scenes

Weak

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.



unsupervised
machine learning

AI is used to *find patterns* in a set of data so that they can be interpreted

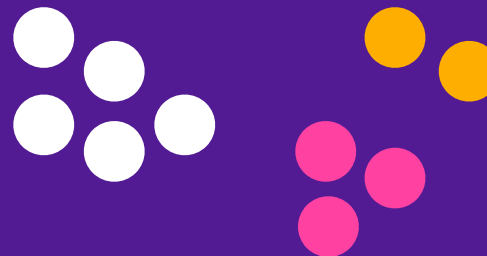
Which areas are more contaminated?

How buildings have been built over the years?

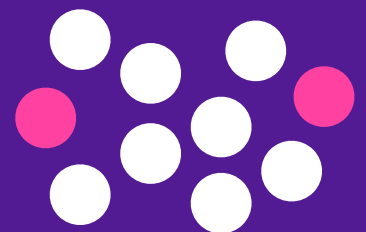
How to group areas based on specific risks?

Which phenomenon has caused another one?

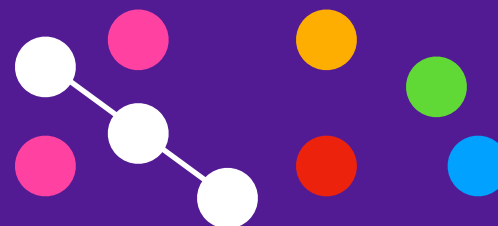
Clustering



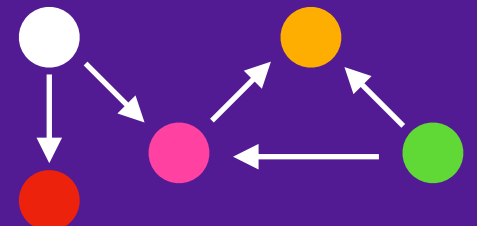
Anomaly Detection



Pattern Recognition



Association



Artificial Intelligence, behind the scenes

Weak

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.

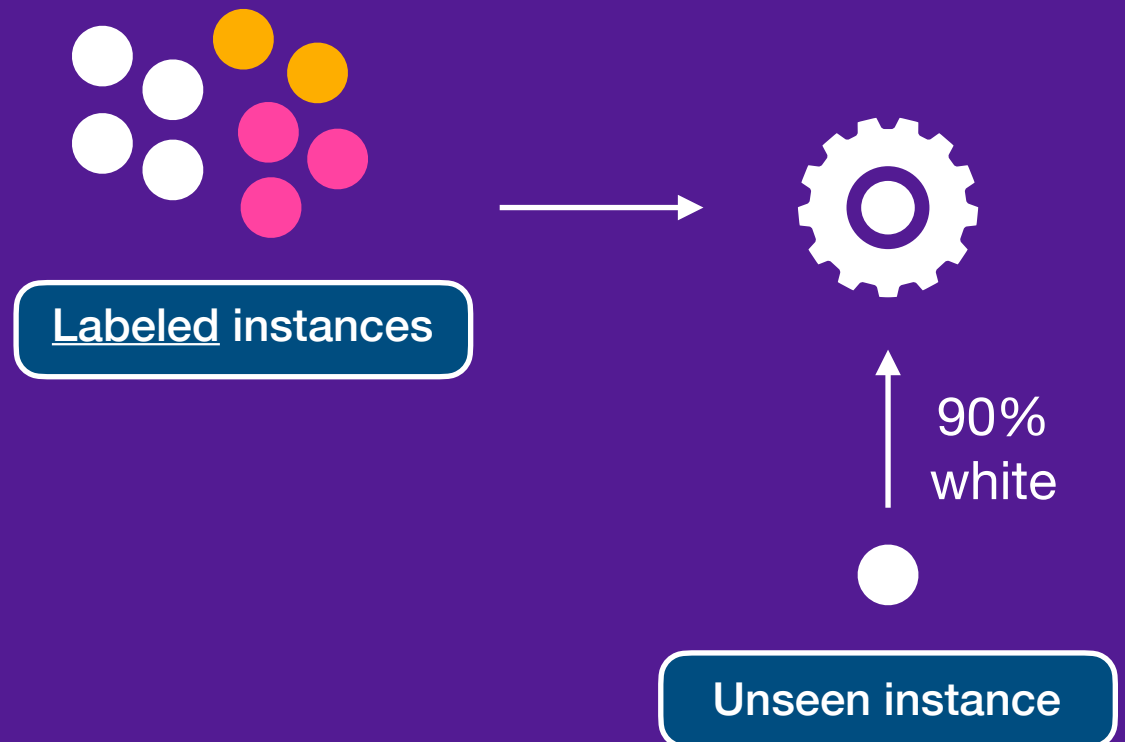


supervised
machine learning

AI is used to *learn patterns* and
predict future trends

Based on knowledge acquired, how will the territory
change in the near future?

Based on knowledge acquired, does it make sense to
build new buildings in a certain area?



Artificial Intelligence, behind the scenes

Weak

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.



deep
machine learning

AI is used to *imitates the inner working* of a human brain

Can we automatically detect spatial objects?

Can we automatically and semantically segment pixels of a geospatial image?

Can we automatically create digital maps from satellite images?

Deep Neural Network



Artificial Intelligence, applications

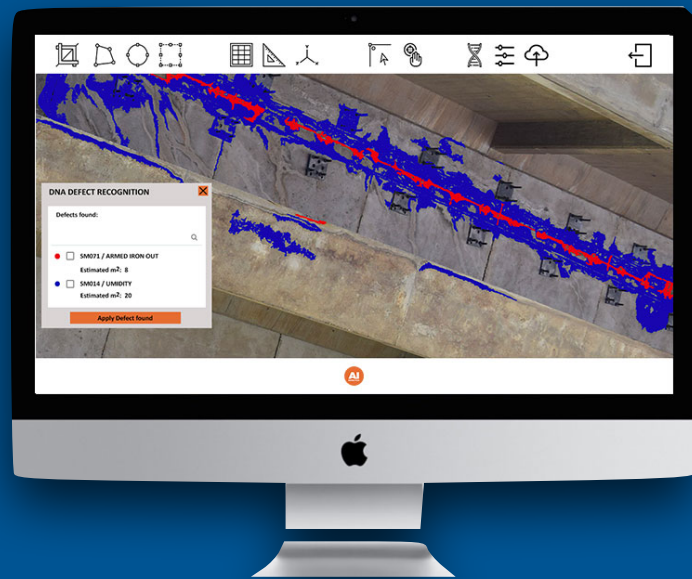
AI & IoT

This is one of the emerging applications of artificial intelligence. IoT devices have sensors to capture information and actuators to act on the environment: weak AI can be used to monitor the environment and preventively operate on it.

Artificial Intelligence, applications

AI & IoT

This is one of the emerging applications of artificial intelligence. IoT devices have sensors to capture information and actuators to act on the environment: weak AI can be used to monitor the environment and preventively operate on it.



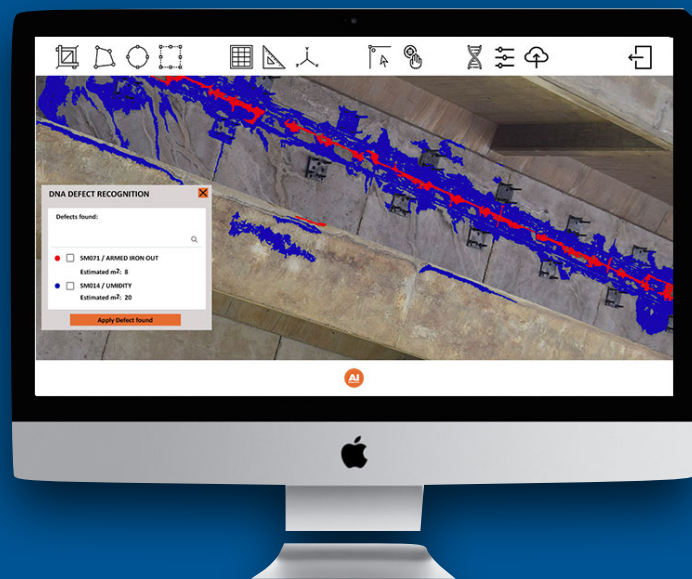
A key example is the so-called *AI-inspection*: data are acquired from sensors and then processed by some AI algorithms that can discover potential issues and suggest preventive maintenance operations.

E.g., bridge degradation, rust detection.

Artificial Intelligence, applications

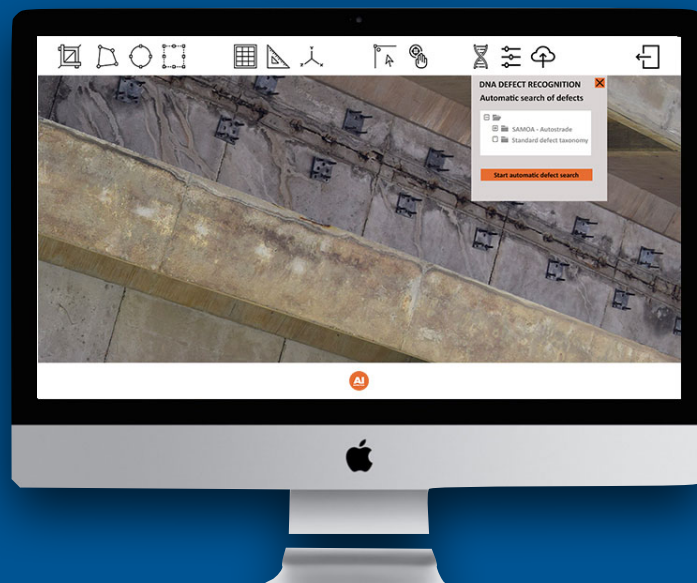
AI & IoT

This is one of the emerging applications of artificial intelligence. IoT devices have sensors to capture information and actuators to act on the environment: weak AI can be used to monitor the environment and preventively operate on it.



A key example is the so-called *AI-inspection*: data are acquired from sensors and then processed by some AI algorithms that can discover potential issues and suggest preventive maintenance operations.

E.g., bridge degradation, rust detection.



Another relevant application consists of combining image recognition techniques with supervised or deep learning mechanisms that can provide an automatic classification of objects on the territory.

E.g., automatic exploration of the environment.

Artificial Intelligence, applications

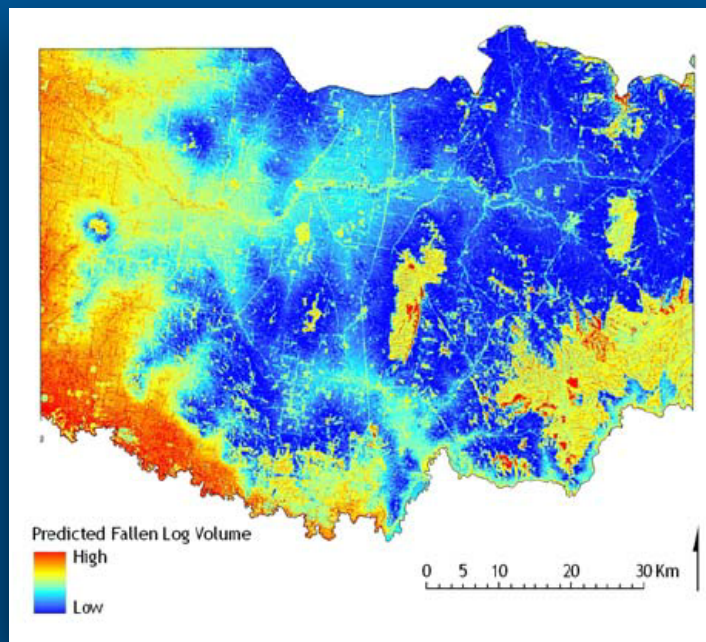
AI & Big Data Analytics

Science is driven by data. The availability of big data naturally enables the exploitation of both weak and strong AI for a number of tasks, especially when these are related to the analysis of the environment.

Artificial Intelligence, applications

AI & Big Data Analytics

Science is driven by data. The availability of big data naturally enables the exploitation of both weak and strong AI for a number of tasks, especially when these are related to the analysis of the environment.

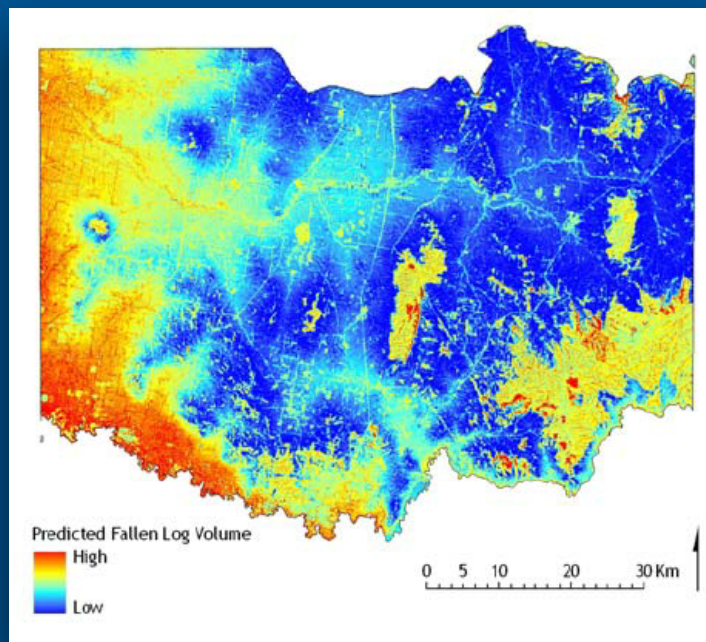


Spatial prediction is already used as a guide to making practical decisions in crime analysis, cellular networking, and natural disasters such as fires, floods, droughts, plant diseases, and earthquakes.

Artificial Intelligence, applications

AI & Big Data Analytics

Science is driven by data. The availability of big data naturally enables the exploitation of both weak and strong AI for a number of tasks, especially when these are related to the analysis of the environment.



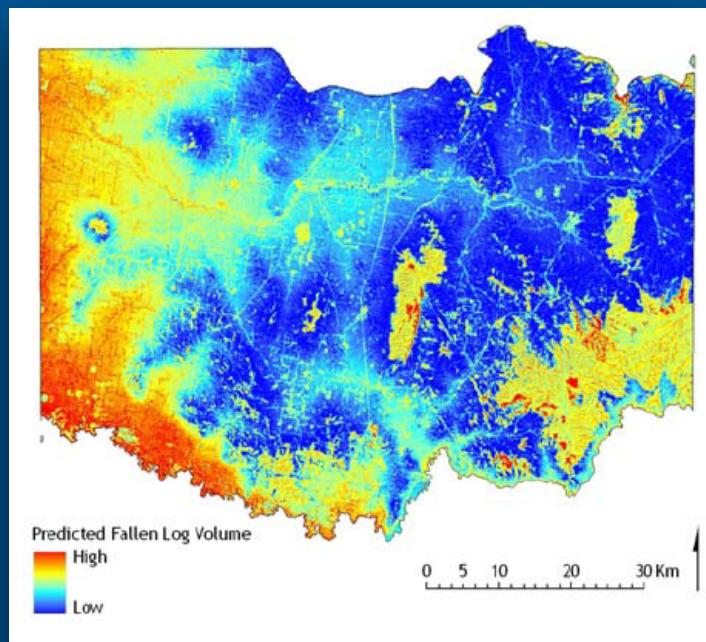
Spatial prediction is already used as a guide to making practical decisions in crime analysis, cellular networking, and natural disasters such as fires, floods, droughts, plant diseases, and earthquakes.

AI & Big Data can also be employed in the context of *consumerization*, where citizens interact with spatial data to add new information to the AI.

Artificial Intelligence, applications

AI & Big Data Analytics

Science is driven by data. The availability of big data naturally enables the exploitation of both weak and strong AI for a number of tasks, especially when these are related to the analysis of the environment.



Spatial prediction is already used as a guide to making practical decisions in crime analysis, cellular networking, and natural disasters such as fires, floods, droughts, plant diseases, and earthquakes.

AI & Big Data can also be employed in the context of *consumerization*, where citizens interact with spatial data to add new information to the AI.

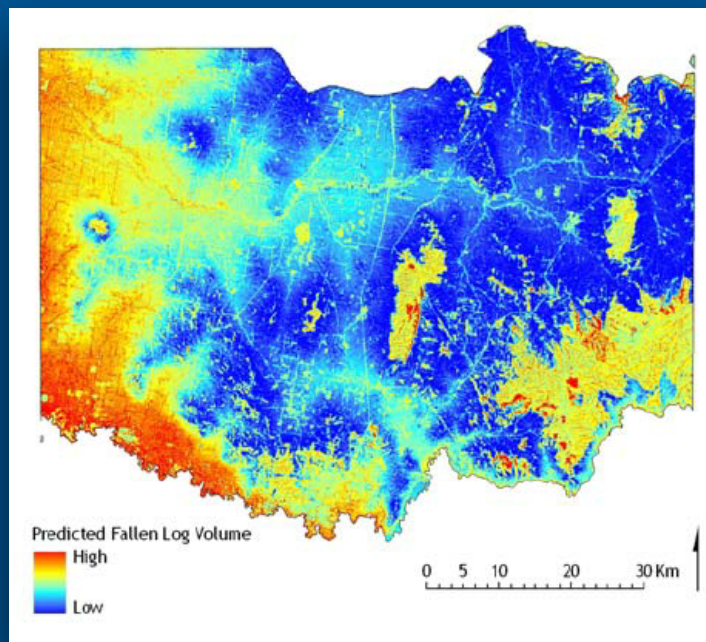


AI has been also associated to the future of cartography: one of the biggest challenges is the automatic identification of new buildings or changes in the arrangement of a city.

Artificial Intelligence, applications

AI & Big Data Analytics

Science is driven by data. The availability of big data naturally enables the exploitation of both weak and strong AI for a number of tasks, especially when these are related to the analysis of the environment.



Spatial prediction is already used as a guide to making practical decisions in crime analysis, cellular networking, and natural disasters such as fires, floods, droughts, plant diseases, and earthquakes.

AI & Big Data can also be employed in the context of *consumerization*, where citizens interact with spatial data to add new information to the AI.



AI has been also associated to the future of cartography: one of the biggest challenges is the automatic identification of new buildings or changes in the arrangement of a city.

The combination of maps and deep learning can solve this problem in an effective manner.

Artificial Intelligence, applications

AI & Remote Sensing

Remote sensing allows to monitor large spaces, collecting data that can be elaborated with the aim of creating new information.

Artificial Intelligence, applications

AI & Remote Sensing

Remote sensing allows to monitor large spaces, collecting data that can be elaborated with the aim of creating new information.



In agriculture, remote sensing is often used to capture characteristics that allow machine learning systems to tell users how much land is devoted to each crop, how healthy the plants are, how quickly they are growing, etc.

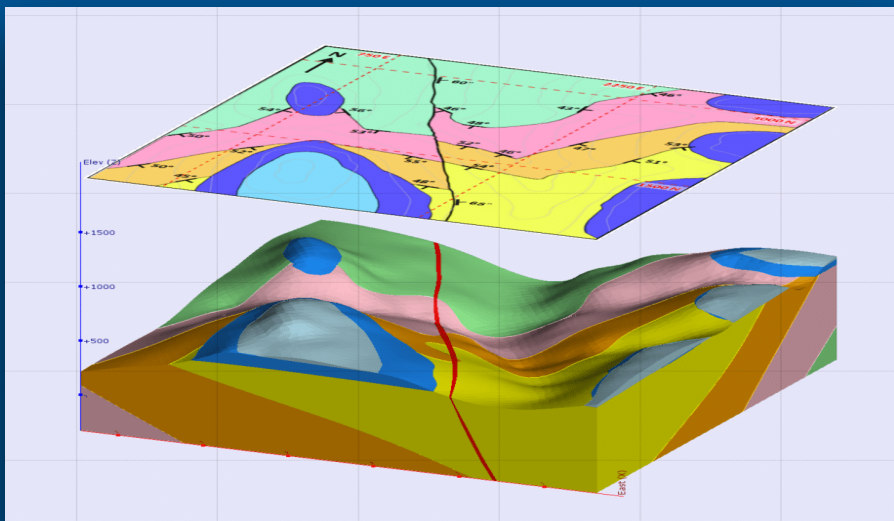
Artificial Intelligence, applications

AI & Remote Sensing

Remote sensing allows to monitor large spaces, collecting data that can be elaborated with the aim of creating new information.



In agriculture, remote sensing is often used to capture characteristics that allow machine learning systems to tell users how much land is devoted to each crop, how healthy the plants are, how quickly they are growing, etc.



Geological mapping is typically done by an operator who go out into the field and record geological information from the rocks that outcrop at the surface.

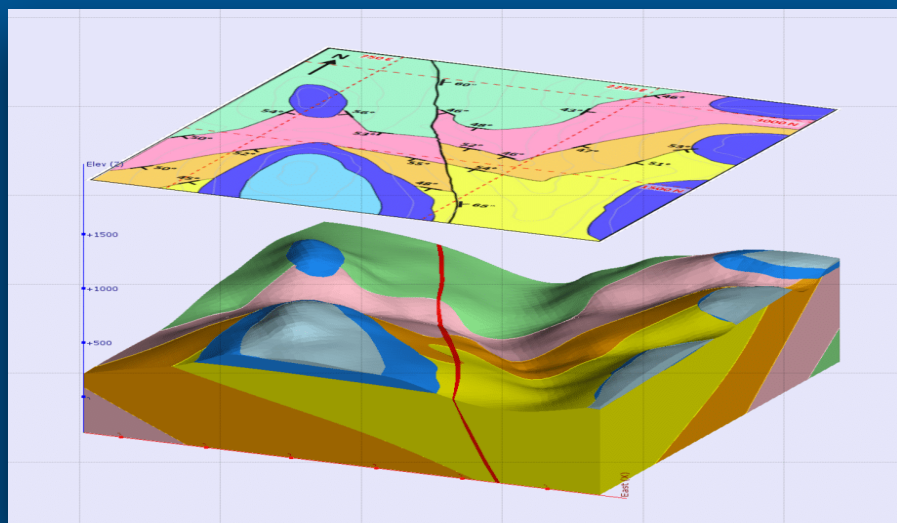
Artificial Intelligence, applications

AI & Remote Sensing

Remote sensing allows to monitor large spaces, collecting data that can be elaborated with the aim of creating new information.



In agriculture, remote sensing is often used to capture characteristics that allow machine learning systems to tell users how much land is devoted to each crop, how healthy the plants are, how quickly they are growing, etc.



Geological mapping is typically done by an operator who go out into the field and record geological information from the rocks that outcrop at the surface.

Novel deep learning algorithms can perform this task automatically, by receiving remote data and identifying the geological information for a given area.

Artificial Intelligence, this unknown

Despite its popularity and the tremendous impact it will have on society in the near future, most of us use artificial intelligence in a *passive* way, as a user of some magic box that in the end provides something potentially useful.

First, AI has a **love relationship** with psychology and cognitive science, before being something mathematical.

AI is "simply" based on the concept of **intelligent agent**. In 1943, Kenneth Craik - in his well-known book "*The Nature of Explanation*" - defined an intelligence agent as:

"An organism able to act upon information it perceives and make decisions based on experience".

Some years later, in 1950, the concept of **artificial intelligence** was formalized by Alan Turing through the *Imitation Game*.

Nowadays, we associate four characteristics to intelligent agents: the abilities of (1) thinking *humanly*, (2) thinking *rationally*, (3) acting *humanly*, and (4) acting *rationally*.

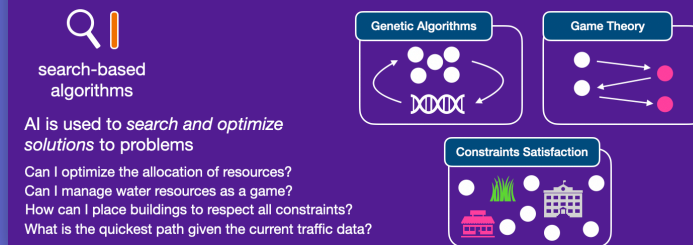


Artificial Intelligence, behind the scenes

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.

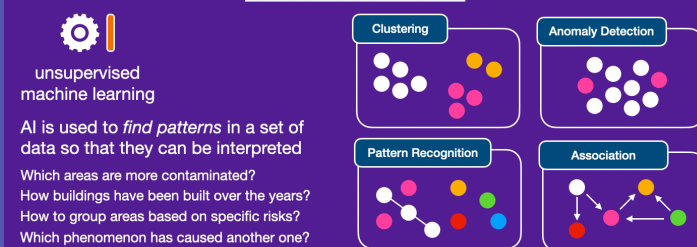


Artificial Intelligence, behind the scenes

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.

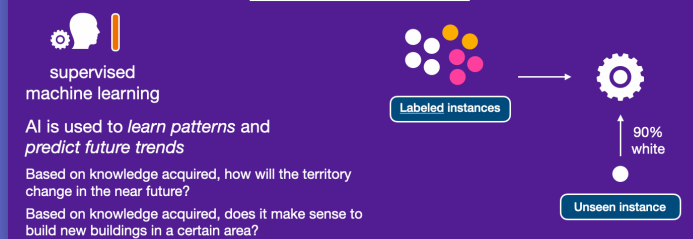


Artificial Intelligence, behind the scenes

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.

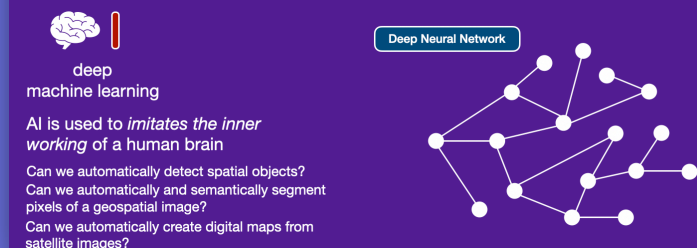


Artificial Intelligence, behind the scenes

Weak (or Narrow) AI refers to the set of algorithms able to address specific tasks, like playing chess or finding a route to reach a city. It implements a *limited part* of the mind.

vs.

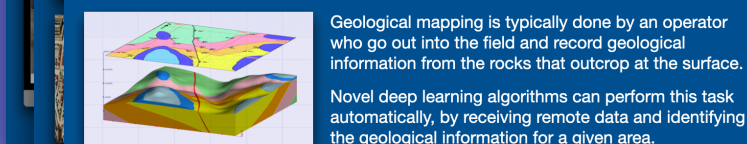
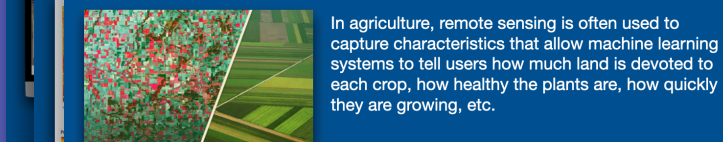
Strong AI aims at simulating or even exceeding the human capabilities with autonomous learning mechanisms. It can *process and make independent decisions* - weak AI only simulates human behavior.



Artificial Intelligence, applications

AI & Remote Sensing

Remote sensing allows to monitor large spaces, collecting data that can be elaborated with the aim of creating new information.



Artificial Intelligence, This Unknown

Fabio Palomba
Assistant Professor
Software Engineering (SeSa) Lab
University of Salerno

fpalomba@unisa.it
[@fabiopalomba3](https://fabiopalomba3)
<https://fpalomba.github.io>

