

Master in Planning and
Management of Tourism Systems

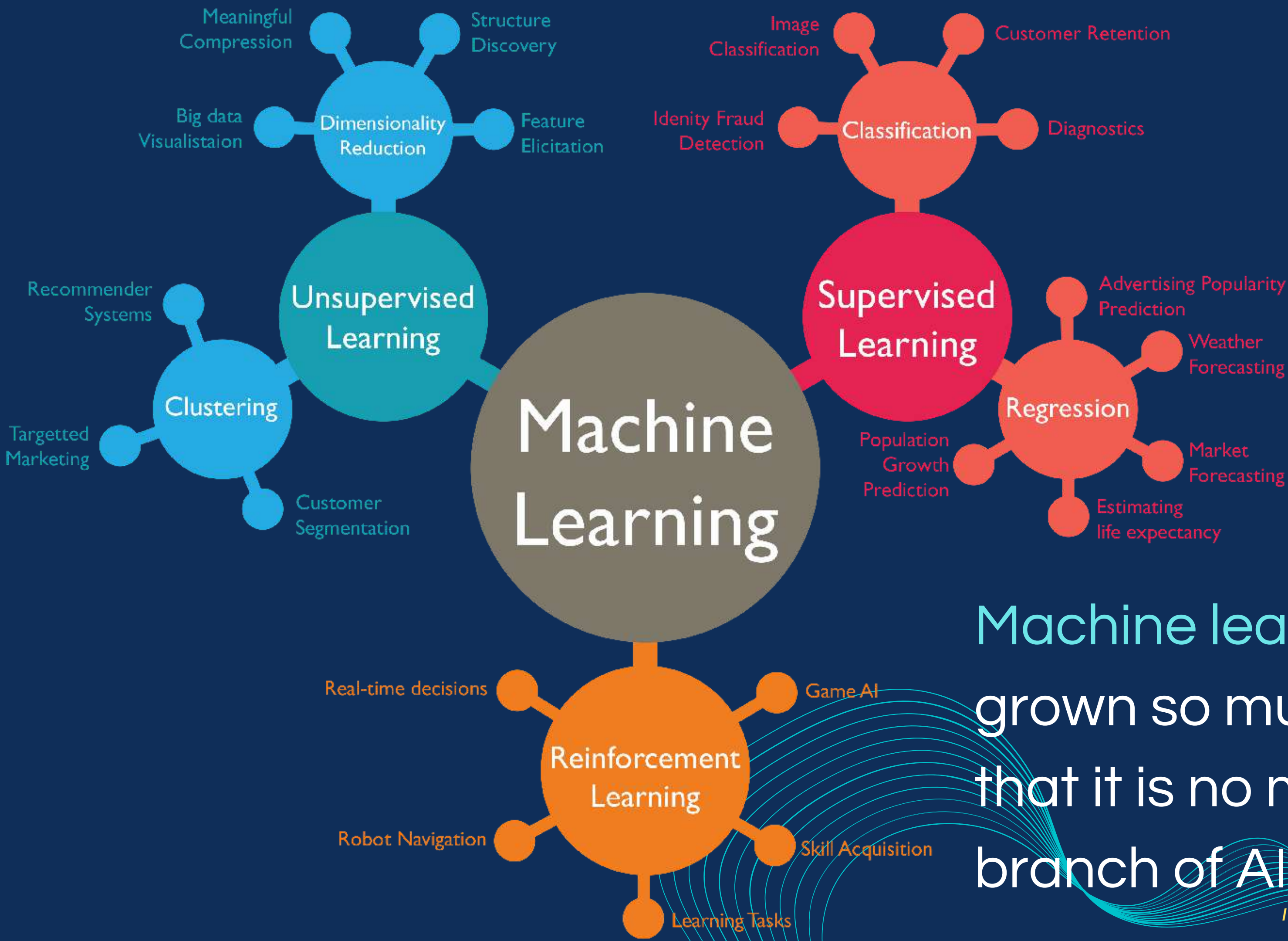


AI & Machine Learning

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MACHINE LEARNING

Before the rise of Large Language Models in 2022, the field of Artificial Intelligence (AI) was dominated by its main sub-branch, Machine Learning (ML)



Machine learning has grown so much recently that it is no more a simple branch of AI

MACHINE LEARNING

For example, it is used to improve diagnosis, for filtering email, for automatic translation and for object recognition

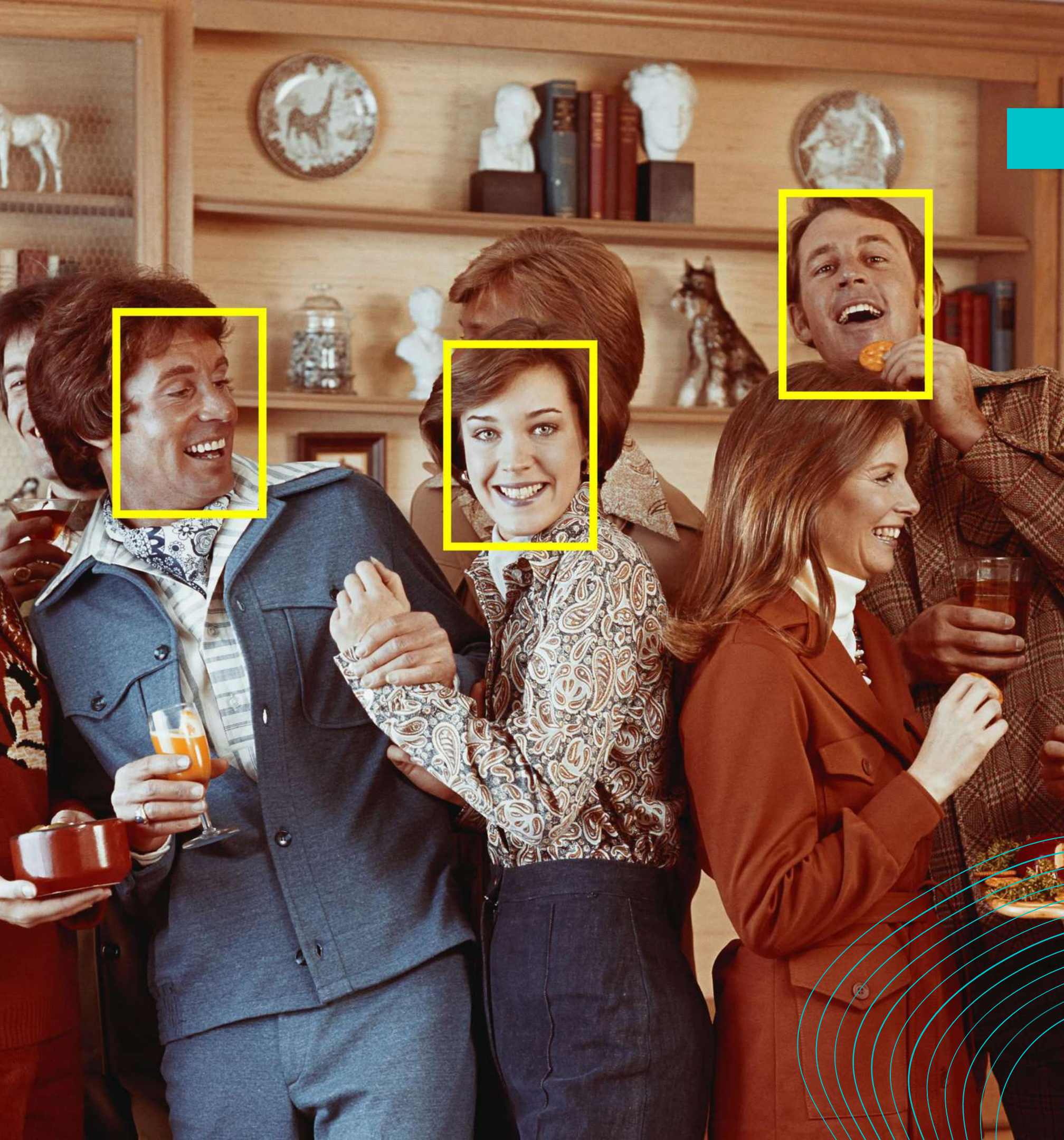
MACHINE LEARNING

Before LLM, it was the algorithm behind voice assistants like Siri, Cortana and Alexa



MACHINE LEARNING

Thanks to ML we can also tag our friend's faces in social media



MACHINE LEARNING

Its main advantage compared to traditional statistical models is that ML doesn't need any formula or equation to make its predictions. ML is basically another approach to statistics

Handwritten mathematical notes and diagrams on a grid background. The notes include:

- Equations for polar coordinates: $r = \sqrt{x^2 + y^2}$, $\theta = \arcsin \frac{y}{r}$, $\cos \varphi = \frac{x}{r}$
- Equations for lines and circles: $y = 3 \cos(\frac{1}{3}\pi + 1)$, $y^2 = 2px$, $y^2 = -2p(x)$
- Limit calculations: $\lim_{x \rightarrow \infty} \frac{5x - 6x - 3}{x^3 - 2x^2 + 4} = \lim_{x \rightarrow \infty} \frac{(x+4)^2}{1} = \frac{y^2}{3} = 1$
- Matrix operations: $A''B D = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 3 & -4 \\ 3 & -2 & -5 \end{bmatrix}$
- Geometric diagrams showing a cone-like structure with a vertical axis and two elliptical bases, and a coordinate system with points A_2 , A_4 , and $B(3,1)$.
- Equations for lines: $BP: y \cdot \frac{1}{4}\pi + \frac{1}{4}$, $0 > -57$, $1 = 3k + b$, $0 = -k + b$
- Equations for circles: $(x+4)^2 = \frac{y^2}{3} = 1$, $y^2 = 2px$



MACHINE LEARNING

For example, if you want to forecast the number of tourists at a certain destination (e.g: Bergamo).



MACHINE LEARNING

The first step of every forecast model, is to identify which are all the variables that may influence the number of tourists in Bergamo

MACHINE LEARNING

In this case they may be the period of the year, fuel prices, room prices, flight prices, train prices, but also rainfall and temperature and the presence of holidays, events, and exhibitions

MACHINE LEARNING

For each day of last 20+ years you know the **historical value** of the total number of tourists in Bergamo and of the other related variables

MACHINE LEARNING

You can plot two variables like the average room prices and the flight prices. Each point represent a single day of last 20 years

number of clusters = 20

Average room price



Average flight prices



MACHINE LEARNING

ML algorithm only groups together nearby points instead of finding a formula that relates the number of tourists in Bergamo as a function of these two variables

number of clusters = 20

Average room price



Average flight prices



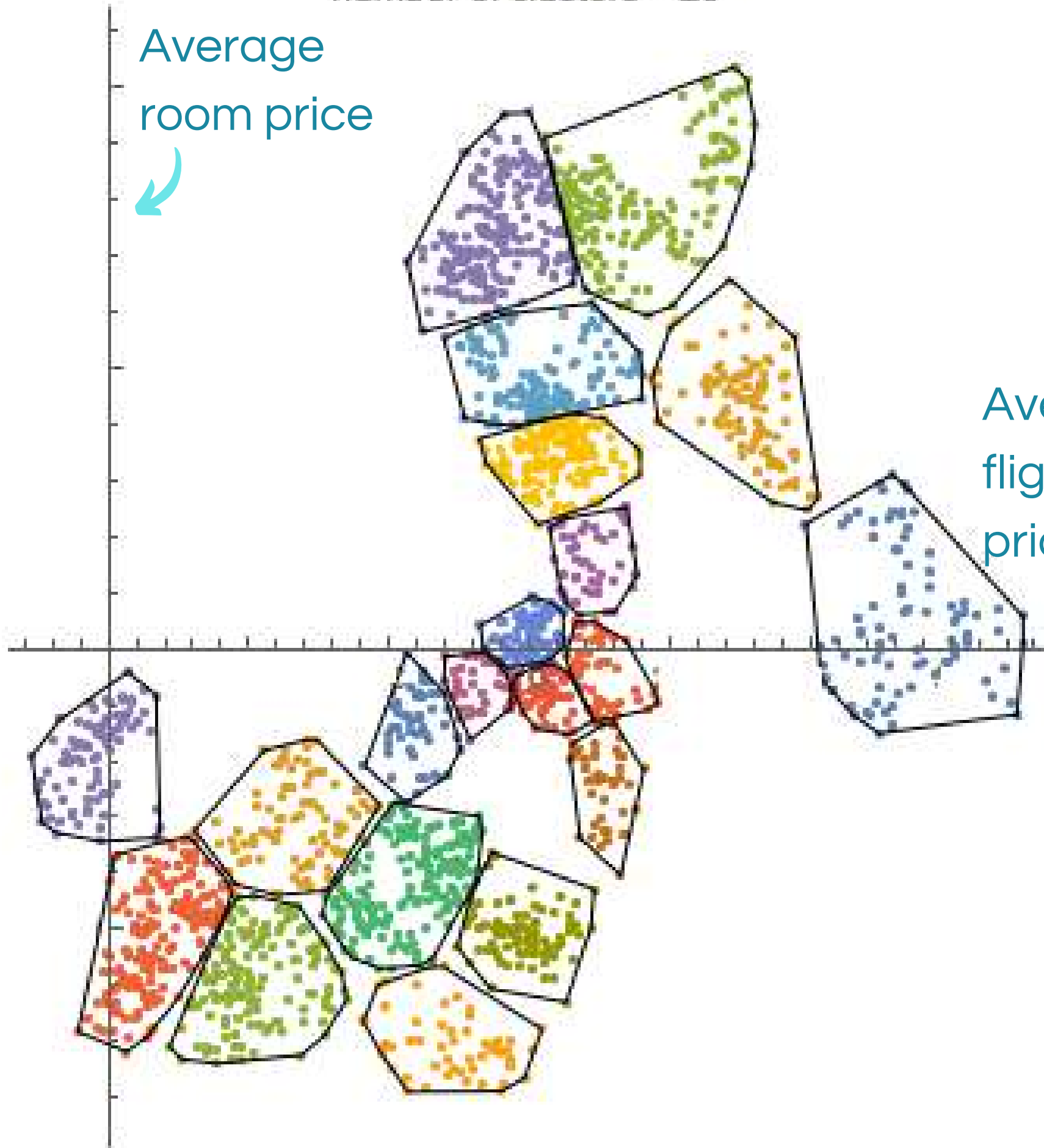
MACHINE LEARNING

In this case, the algorithm detects that points can be organized in 20 groups (called clusters)

number of clusters = 20

Average room price

Average flight prices



MACHINE LEARNING

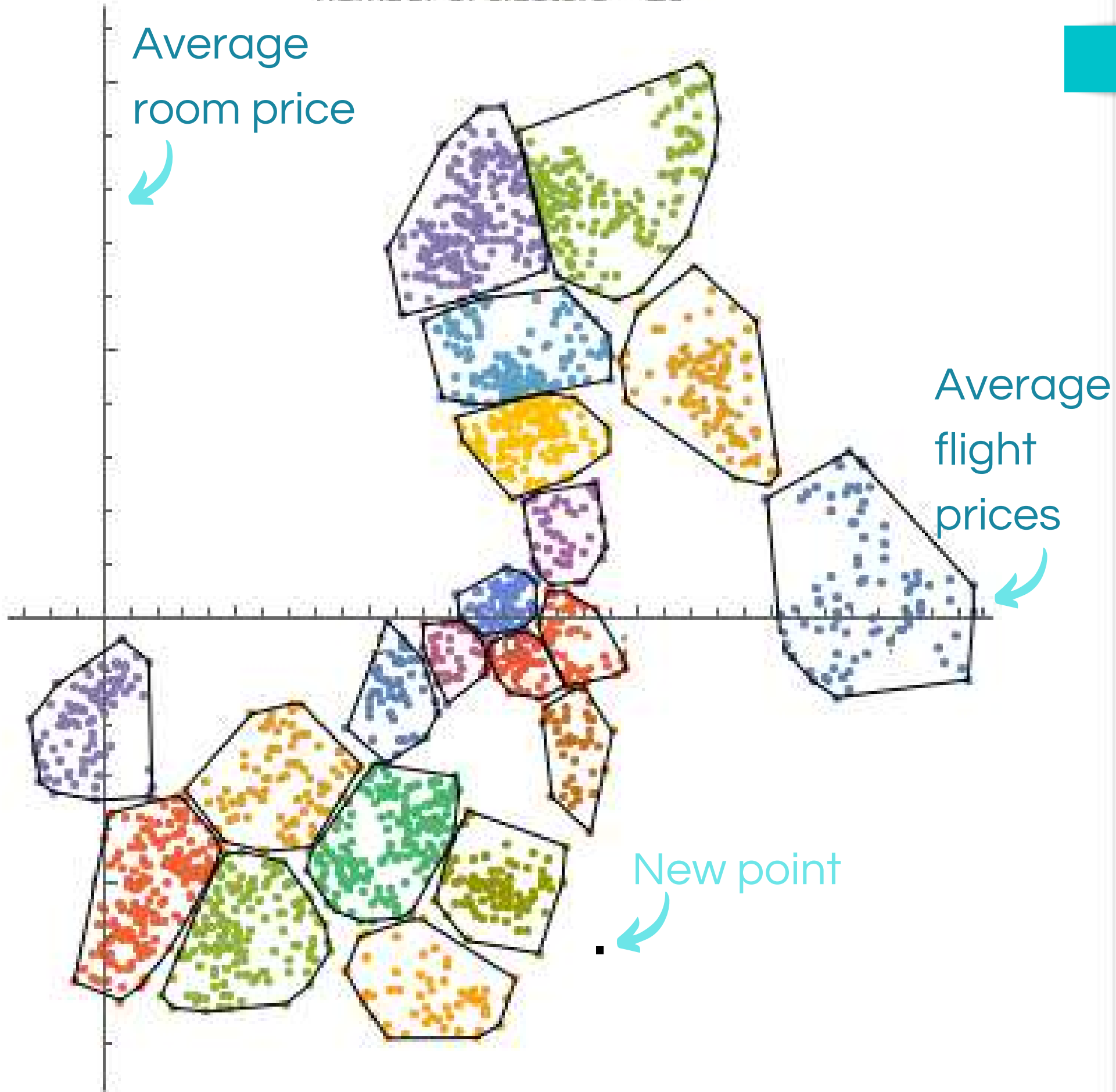
To predict the number of tourists, we just plot the new point corresponding to the day you want to forecast, and you look at which cluster it belongs or it is closer to

number of clusters = 20

Average room price

Average flight prices

New point



MACHINE LEARNING

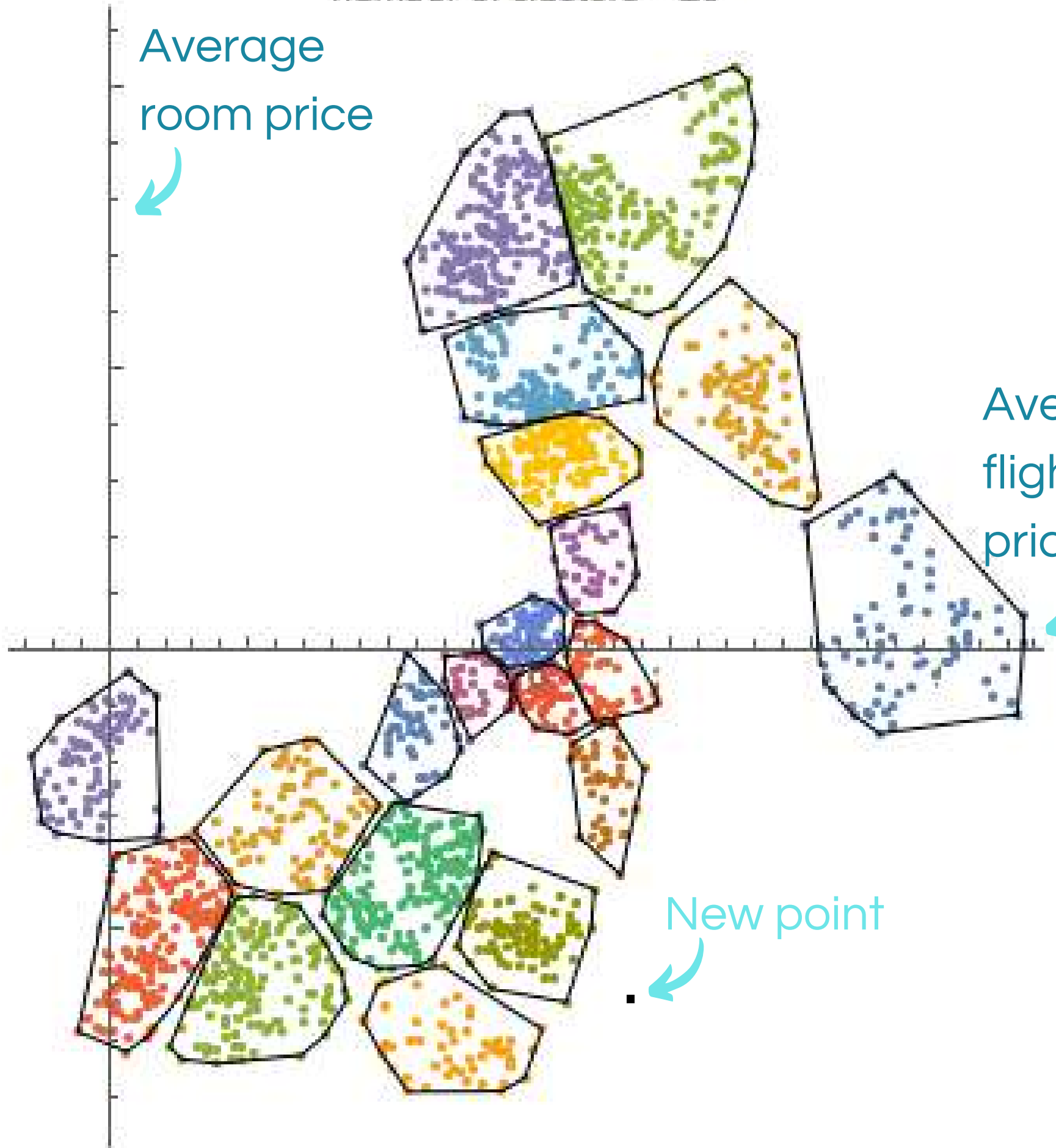
For example, the new point is closer to the green cluster, so it is associated to it

number of clusters = 20

Average room price

Average flight prices

New point



MACHINE LEARNING

Then, the algorithm assign to the new point the same number of tourists associated to the green cluster (usually the average number of tourists of all its points)

number of clusters = 20

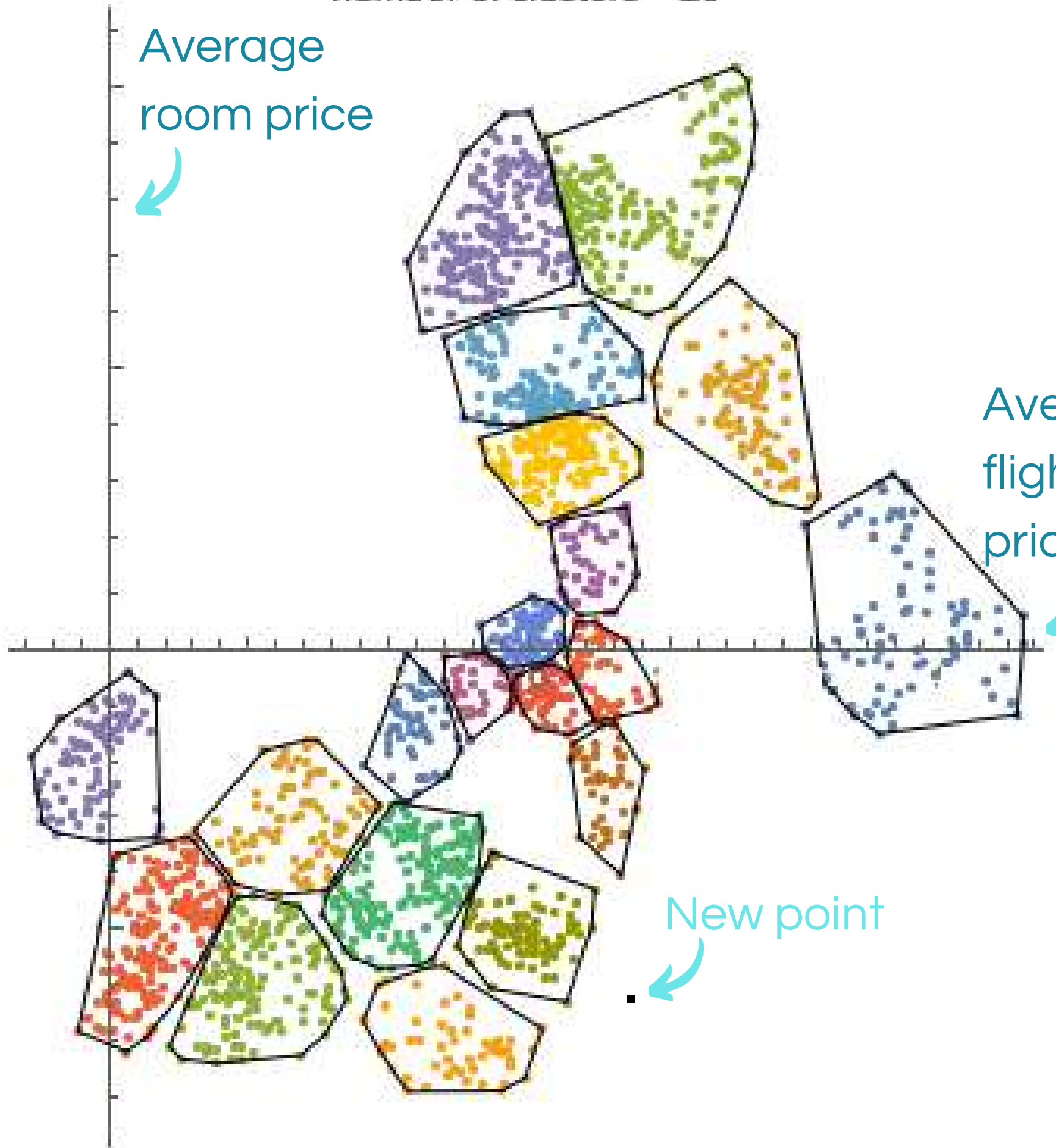
Average room price



Average flight prices



New point



MACHINE LEARNING

The only assumption of ML is that points close between them also have a similar number of tourists, which is a reasonable one if your variables are highly related to the number of tourists.

number of clusters = 20

Average room price



Average flight prices



New point



MACHINE LEARNING

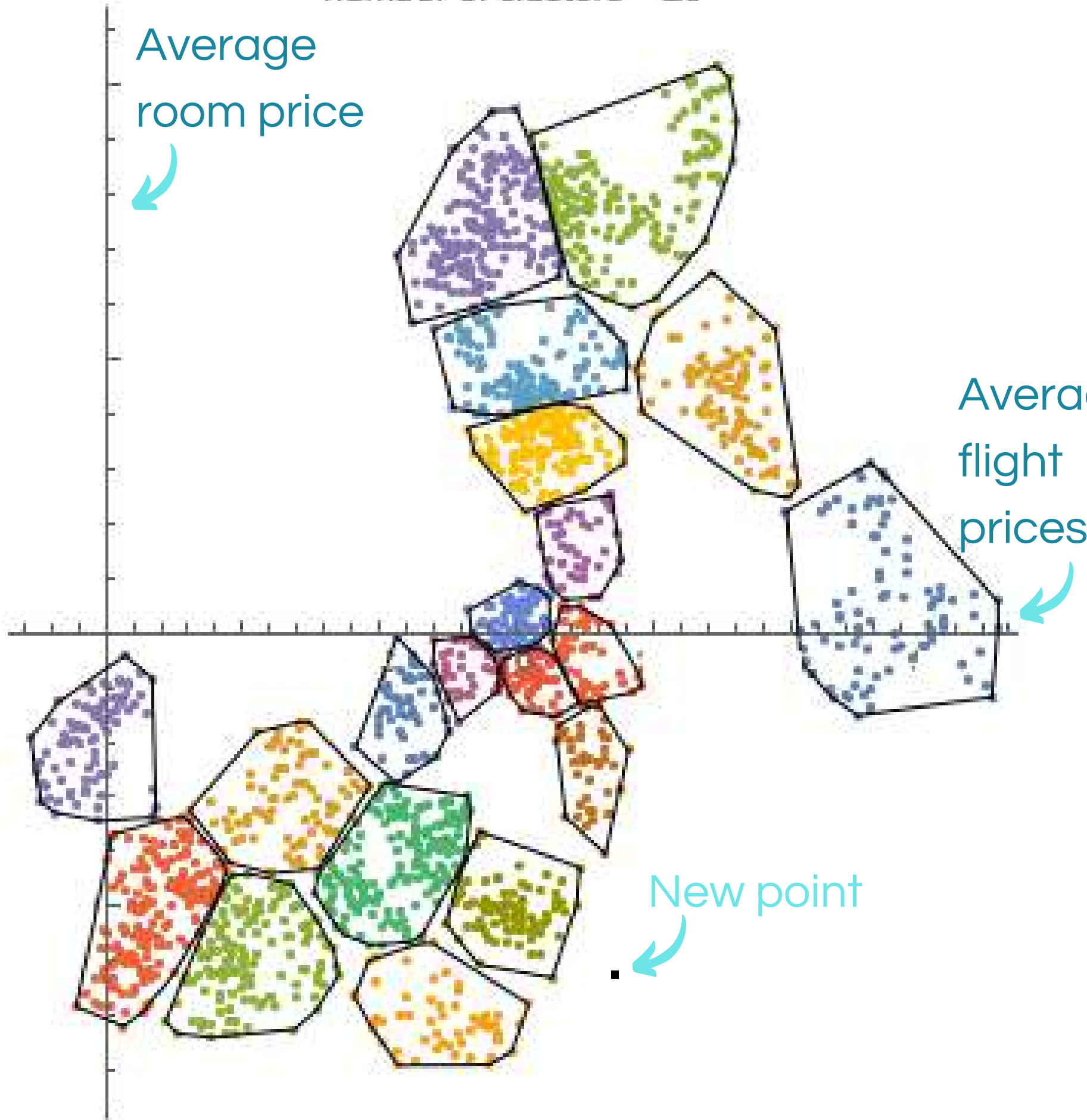
In this graph we only showed two variables for ease of viewing, but usually ML models employs many more. Anyway, their principle is the same

number of clusters = 20

Average room price

Average flight prices

New point



MACHINE LEARNING

It's better to use ML in conjunction with Big Data so the number of points available from past observation is very high and the new point is closer to its clusters, improving the forecasts

number of clusters = 20

Average room price



Average flight prices



New point



MACHINE LEARNING

The methodology behind many ML techniques (this one is called Clustering Analysis) is not complicated, only its application is.

number of clusters = 20

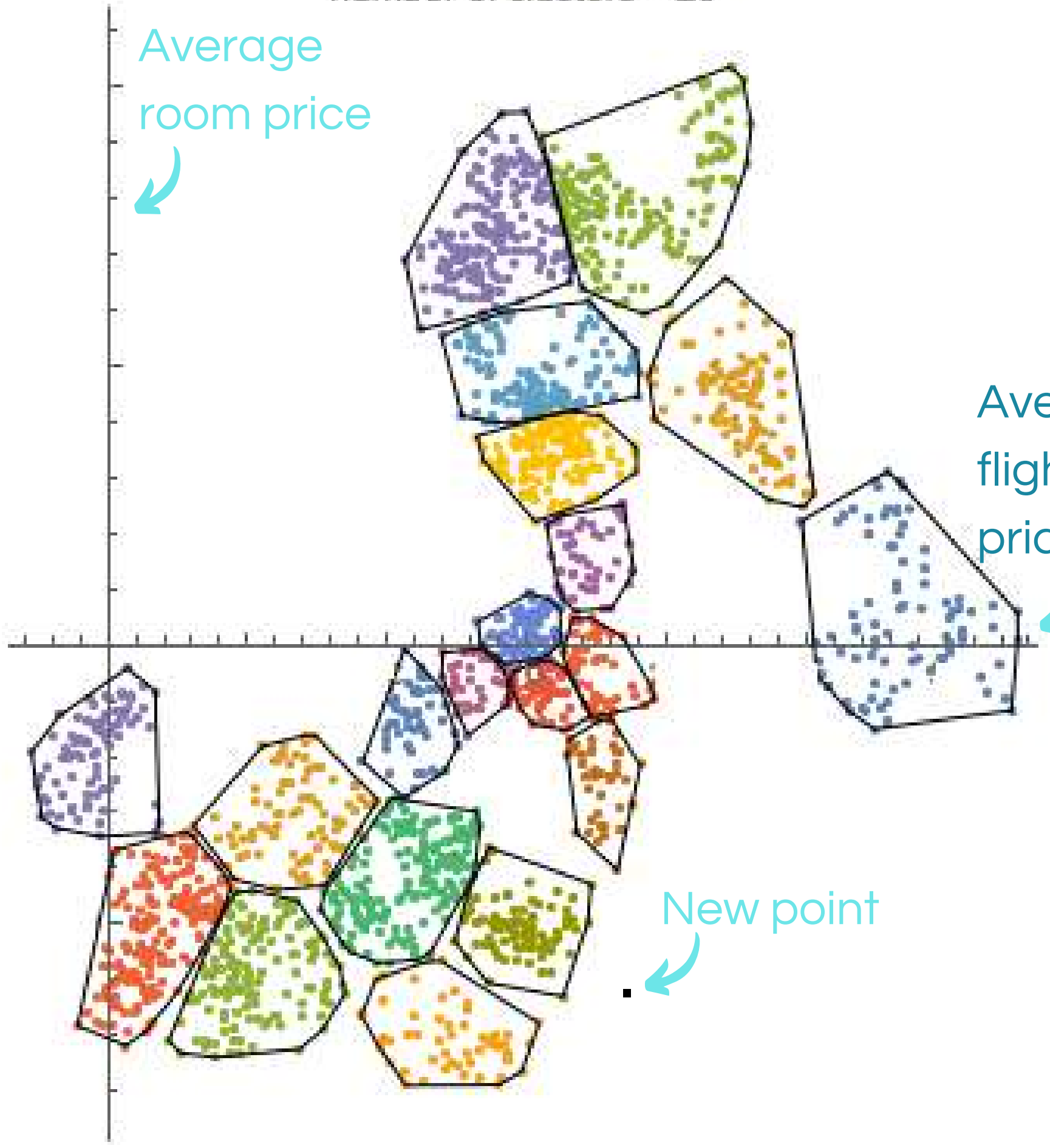
Average room price



Average flight prices

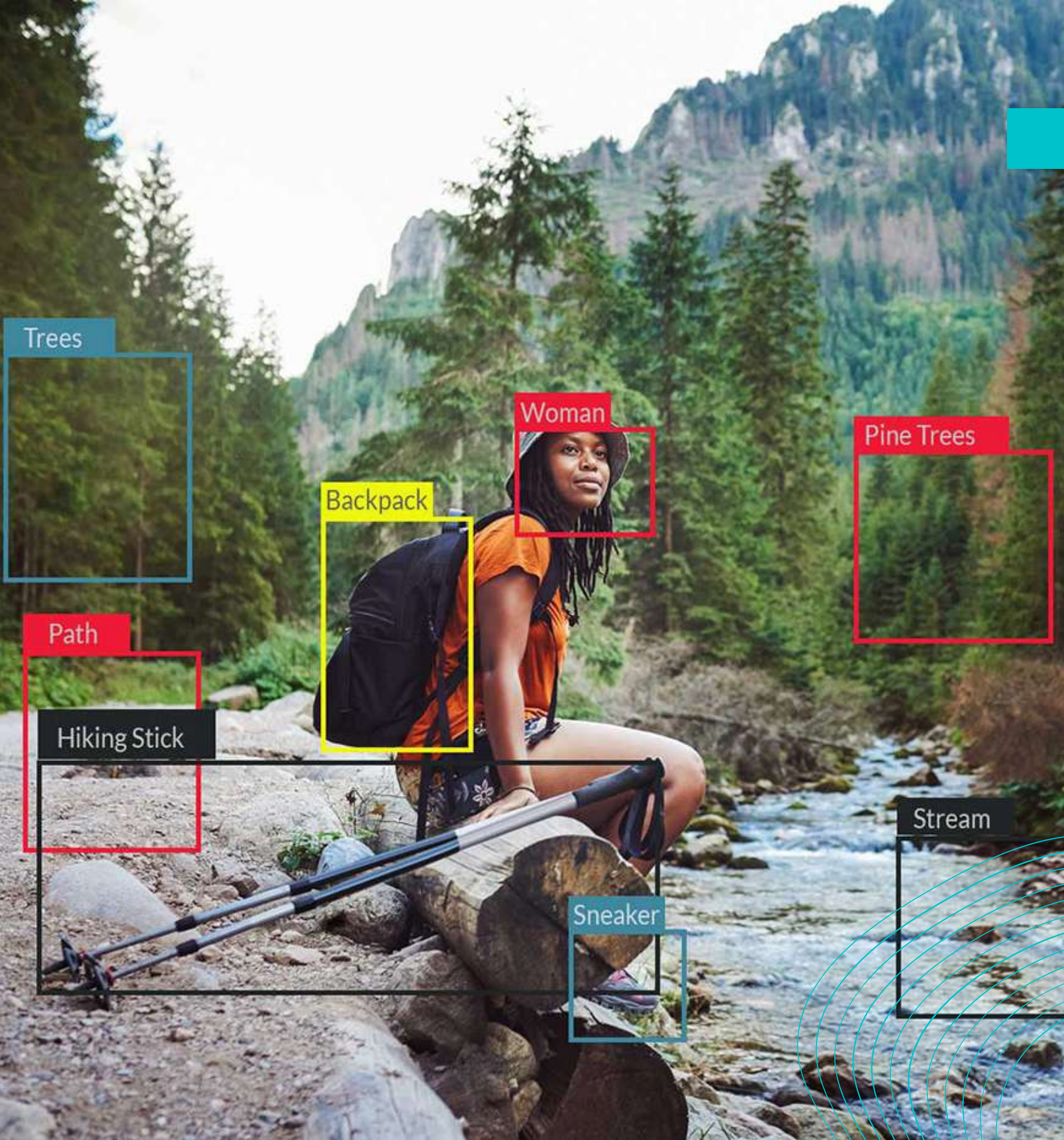


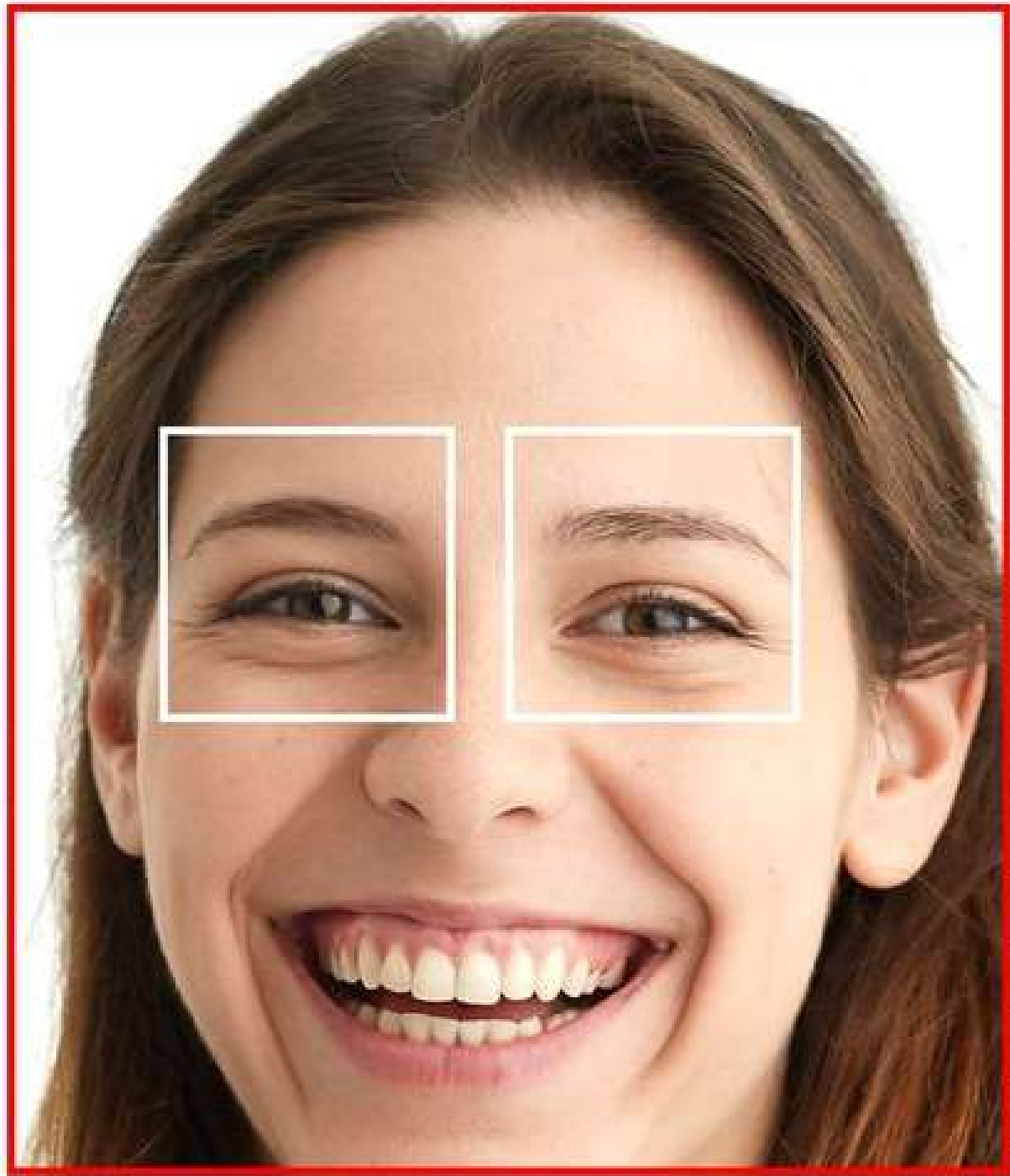
New point



MACHINE LEARNING

The most important advance in AI and machine learning of last decade before LLM was object recognition





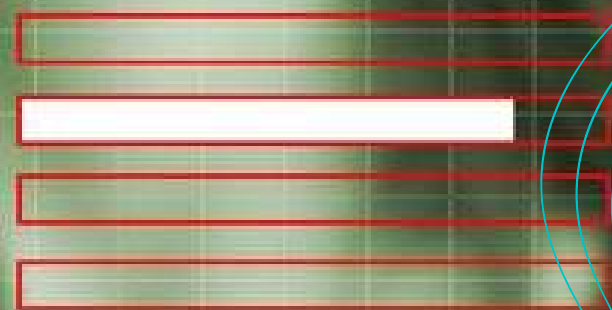
OBJECT RECOGNITION

Object recognition was made possible thanks to a breakthrough in 2015, when the level of accuracy of facial recognition finally surpassed 95%.

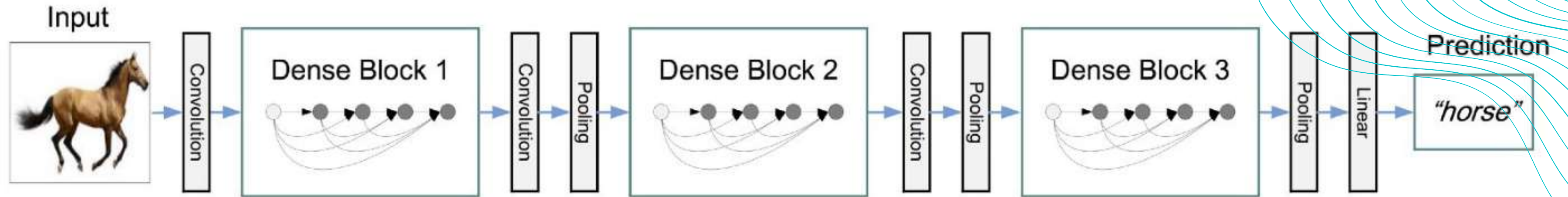
Age 25 [+/-9]

Gender Female

Angry
Happy
Sad
Surprised



OBJECT RECOGNITION



It employs a ML technique called **Convolutional Neural Networks**

OBJECT RECOGNITION

The secret is to reduce the size and complexity of the original image, without removing the most important elements





OBJECT RECOGNITION

Once the image is reduced to a few colors and pixels, the algorithm is able to recognize the shape of the horse quickly and efficiently.

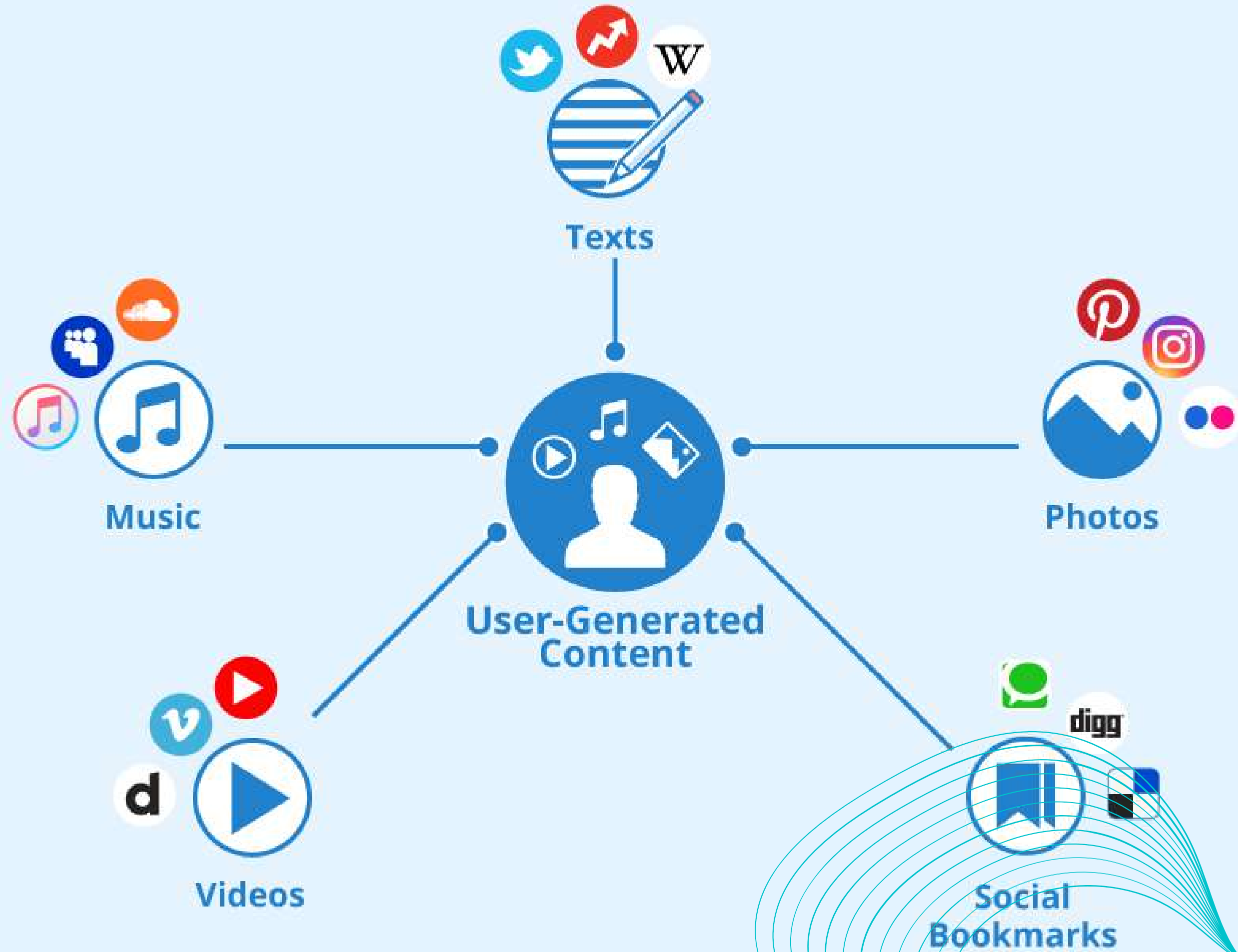
IMPACT OF AI ON TOURISM

1. To process user-generated content collected from Big Data before it can be properly used.



IMPACT OF AI ON TOURISM

AI tags characteristics of pictures, audios, or videos shared by users and can also identify **sentiments** from textual or visual information



These techniques makes user-generated content much more useful, by providing information not only from text sources



"If you like adventure and culture, you might want to go to Alicante."

Smart travel assistants are apps that have access to the user's data (i.e., his/her preferences, interests, availability) and are thus able to provide suggestions on-demand or autonomously, anticipating the user's needs.

Which digital assistants are people using?



19%

Microsoft
Cortana



36%

Apple's
Siri



36%

Google
Assistant



25%

Amazon
Alexa



1%

Other

Also **Chatbots** (both textual and vocal) are increasingly used, not only as personal assistants but also in web sites of **online travel agencies** as Booking.com or Airbnb

IMPACT OF AI ON TOURISM

What's my flight status?

Your flight is on time and is scheduled for 6:00 AM*

If you are making plans for a vacation and are **on a budget**, currently you have to spend hours looking for flights, accommodation and car rentals, comparing prices of different sites

*For Triplt Pro users only

IMPACT OF AI ON TOURISM

What's my flight status?

Your flight is on time and is scheduled for 6:00 AM*

A bot powered by AI will be able to collate all this information and generate tailored recommendations based on your profile, saving your hours of work

*For Triplt Pro users only

IMPACT OF AI ON TOURISM

Once at their destination, tourists must navigate the realm of the unknown, characterized by differing habits, languages, cultural norms, and cuisine, etc.

IMPACT OF AI ON TOURISM

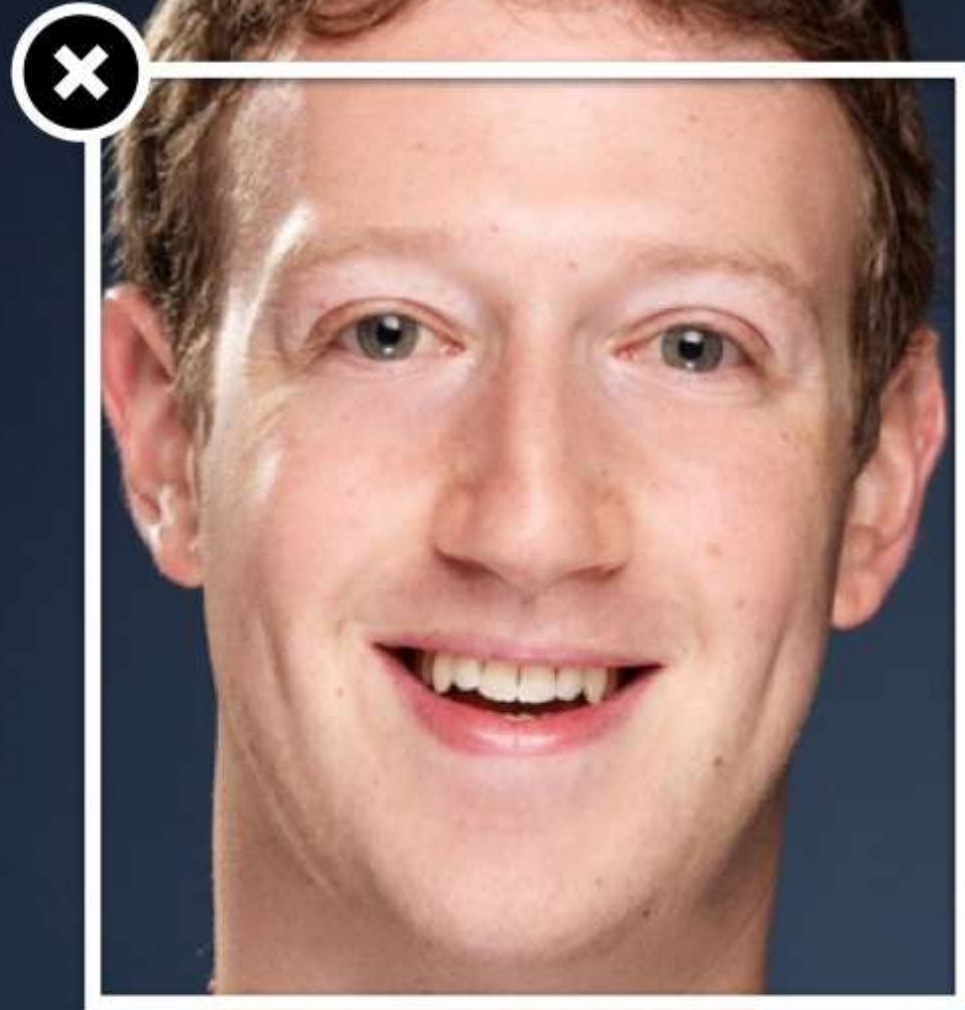
AI can help them recommending a travel itinerary, or helping with language and cultural barriers that prevent tourists from exploring the local culture

AI is helping the development of automatic translation applications and simultaneous translation systems that'd greatly improve the tourist's experience (see <https://hu.ma.ne/aipin>)



IMPACT OF AI ON TOURISM

Face recognition can be used in the check-in process to automatically recognize guests



Mark Zuckerberg



IMPACT OF AI ON TOURISM

Happy

It can also be used to count the number of people in a certain area and even to detect emotions in the people who pass by a certain point (e.g: happiness of those leaving the breakfast buffet)

IMPACT OF AI ON TOURISM

Forecasting of tourism demand of a destination is well suited for AI algorithms, particularly when the inputs come from **Big Data**



IMPACT OF AI ON TOURISM

AI may become an important tool to develop marketing strategies, financial management and allocation of human resource.



IMPACT OF AI ON TOURISM

For example, Hopper is an app based on ML to predict optimal flight and hotel prices that already sold more than \$600 million worth of flight tickets



KNOW WHEN TO FLY AND BUY

IMPACT OF AI ON TOURISM

When a traveler is tracking a flight, the app provides recommendations on whether he/she should buy it now or **wait for a better price**



KNOW WHEN TO FLY AND BUY

IMPACT OF AI ON TOURISM

Smart Destinations rely not only on Big Data but also on AI to analyse all data

IMPACT OF AI ON TOURISM

6. IA can be integrated in travel apps to make them smarter (e.g: find a trekking around the town that you didn't do already)

IMPACT OF AI ON TOURISM

7. AI may allocate hotel rooms according to guest value and preferences, and can adapt the cuisine available in restaurants to the tastes of the customers



IMPACT OF AI ON TOURISM

It also helps select the most appropriate employees, and it improves energy management of the hotel and tourist consumption

IMPACT OF AI ON TOURISM

Identify the best match between tourists and travel packages, tailoring them to their needs

IMPACT OF AI ON TOURISM

Tourists need to make a series of decisions about future trips: choosing a destination, transport, accommodation, activities, and so on

IMPACT OF AI ON TOURISM

These decisions have a significant impact on tourists' satisfaction with their trip. Tourists have an almost infinite array of options, so they need assistance

IMPACT OF AI ON TOURISM

Until now they usually asked to travel agents, but the process of matching demand with a product is **very complex** one and it may be better suited to the **AI** than to humans

IMPACT OF AI ON TOURISM

However, it requires a large amount of information about user behavior, so that an accurate user profile can be defined

IMPACT OF AI ON TOURISM

Thus, travel agencies that employ AI will probably change from marketing to many people to marketing to one

IMPACT OF AI ON TOURISM

AI also facilitates the use of robots in the front desk, for delivery and stock management





IMPACT OF AI ON TOURISM

The role of humans in the hospitality sector will change: they will develop a small set of tasks that are extremely difficult to automate

IMPACT OF AI ON TOURISM

Human presence will be used as a **distinction** and **luxury**; it will be a differential factor, as is currently the case in **gas stations**, where you can choose to be served or not

IMPACT OF AI ON TOURISM

25% of the workforce in hospitality sector could be replaced by robots in the next decade (Bowen and Morosan, 2018)

IMPACT OF AI ON TOURISM

However, in this case the tourism sector will lose part of its **sense of hospitality**, which is one of its core features



CONCLUSIONS

Overall, AI'll probably enhance the tourism experience and make it better for all the actors: Businesses will be able to understand their customers better

CONCLUSIONS

From the tourists perspective, AI will allow them to prepare their trips more quickly, with lower transaction costs and a fully personalized package that suits their needs and interests

CONCLUSIONS

ideally, language and cultural differences will not be barriers to tourism as they are today, but an additional attraction instead

CONCLUSIONS

On the other hand, there will be cases in which using machines is **compulsory** and not just an option, as is already occurring in some **airports**

CONCLUSIONS

In some cases, technology will substitute humans, but the possible labor costs will not be translated to customers, who may even pay the same to get a **worse overall experience**

CONCLUSIONS

The privacy and safety of data will not always be guaranteed. Employees will find it difficult to work hand in hand with robots and AI systems.

ARTICLES:

In the Moodle there is an article on the impact of AI on Tourism:

- Bulchand (2020): Impact of AI in Travel, Tourism and Hospitality