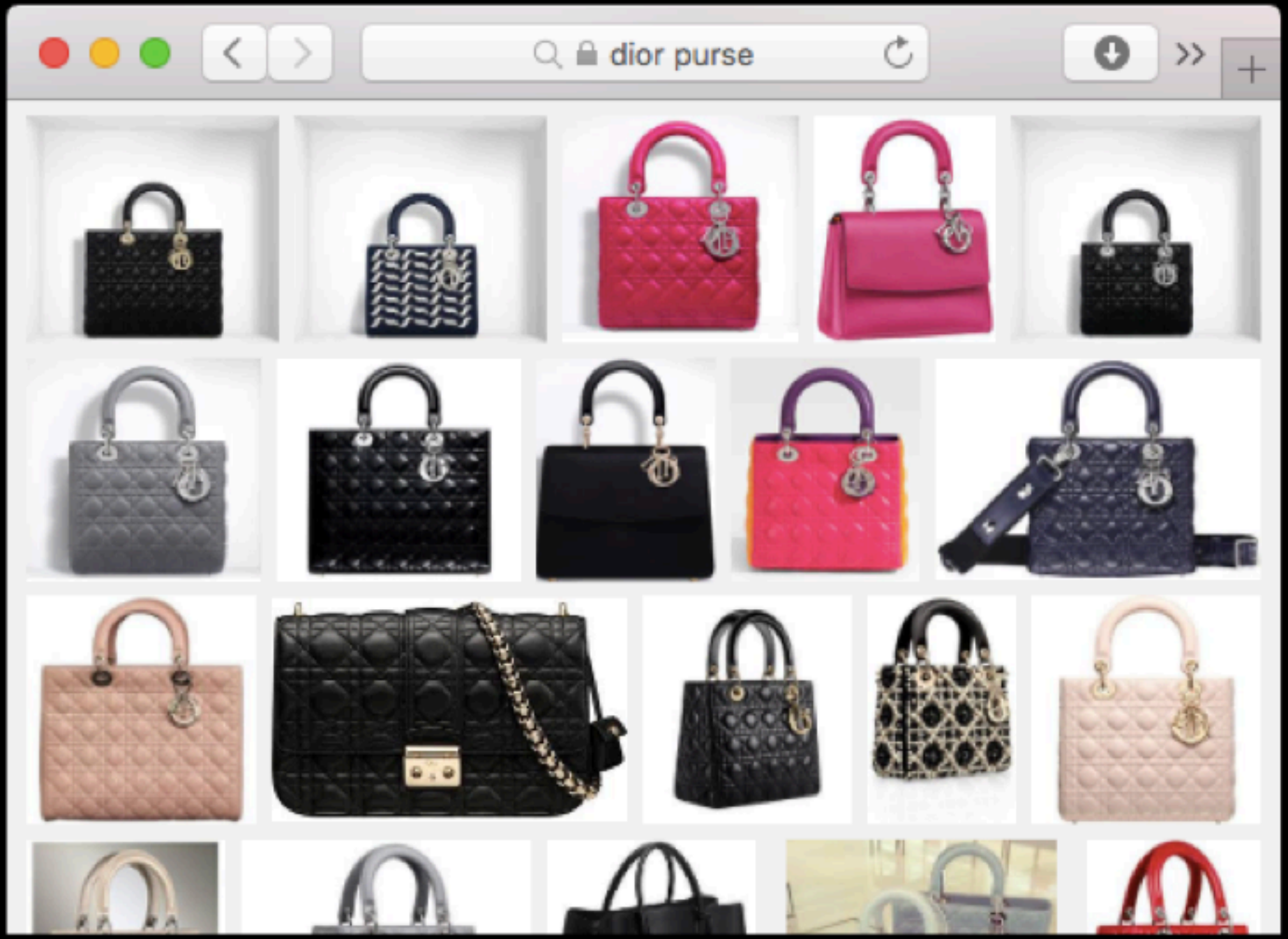
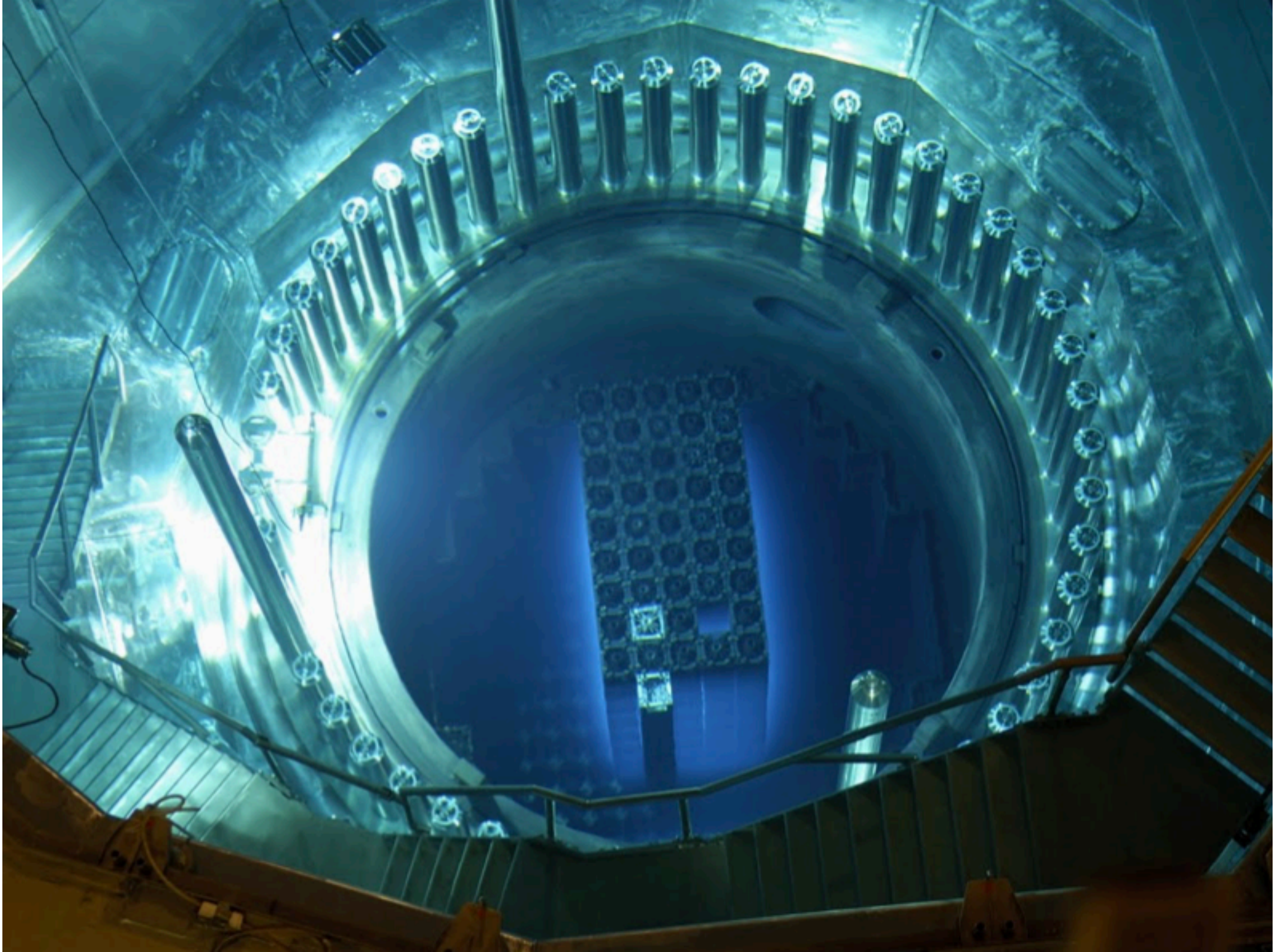

dior purse

Can (and should) everyone be taught about AI?

Blaž Zupan
University of Ljubljana, Slovenia
Baylor College of Medicine, Houston, USA

Völklingen Ironworks, Saarland



Biology

Chemistry

Physics

Mathematics

Technical Education

Internal Combustion Engine

Biology	oil
Chemistry	combustion
Physics	gas law
Mathematics	gears
Technical Education	four-stroke cycle

Biotechnology

Biology

Chemistry

Physics

Mathematics

Technical Education

cell

DNA and RNA

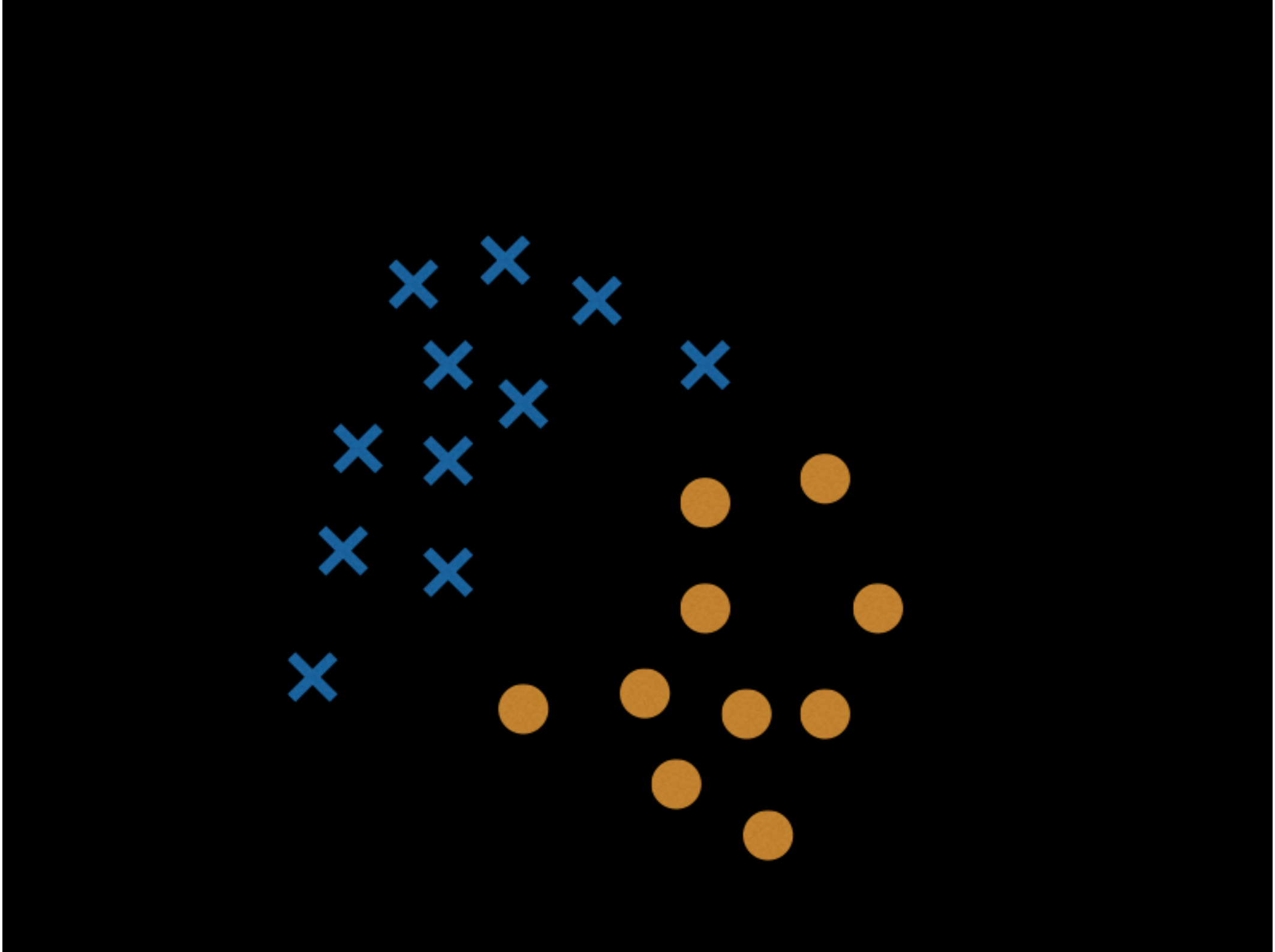
proteins

metabolism

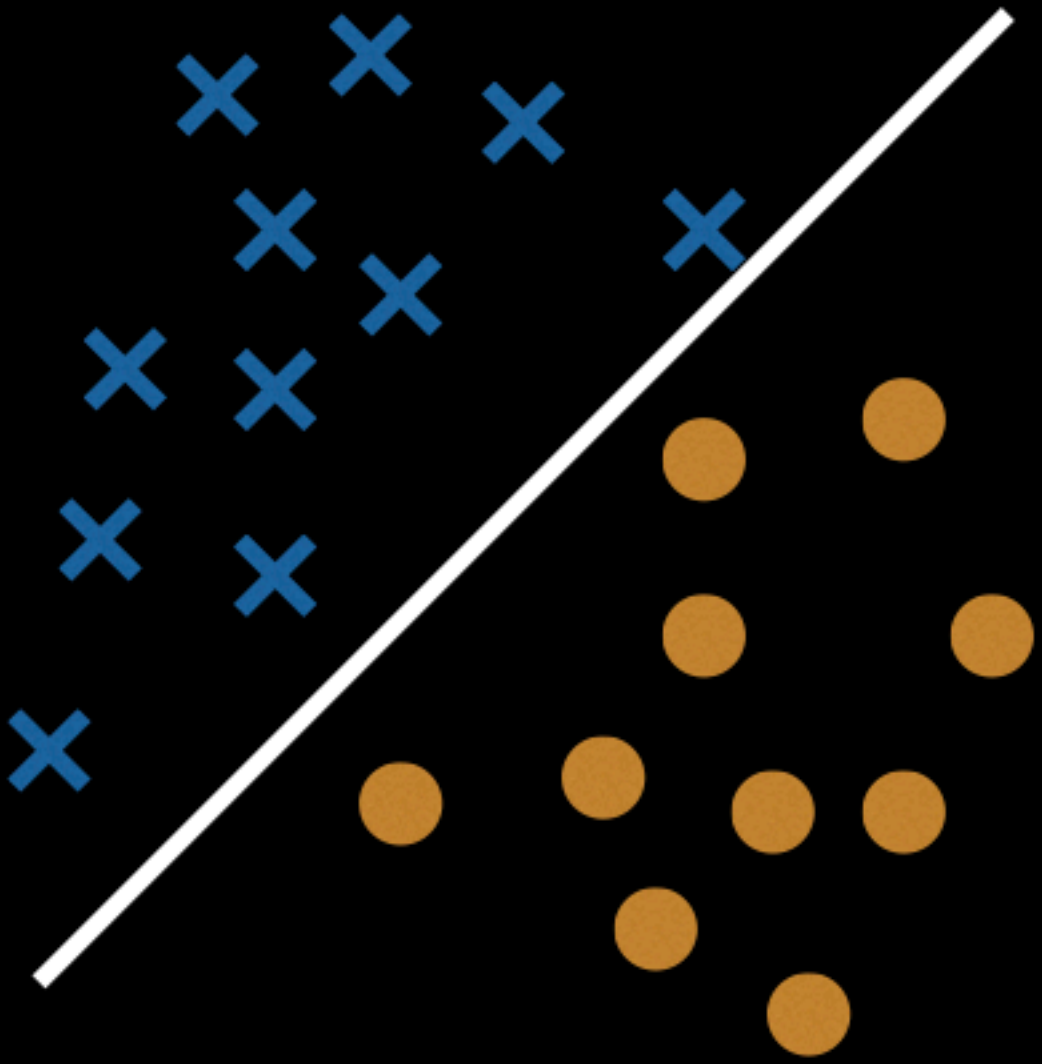
inheritance and evolution

```python
def h(theta, x):
    """Logistic function"""
    return 1. / (1 + np.exp(-x.dot(theta)))


def grad_ascent(x, y, alpha=0.001, epochs=1000000):
    """Gradient ascent."""
    theta = np.zeros(x.shape[1]).T
    for i in range(epochs):
        theta += alpha * (y - h(theta, x)).dot(x)
    return theta
```



logistic regression
(neuron, the building block of all neural networks)



Artificial Intelligence

Biology

Chemistry

Physics

Mathematics

Technical Education

Assumptions

Artificial intelligence is the
defining technology of the 21st century.

Just like transistors in 20th century,
AI will affect all scopes of life.

At present, except for a few enlightened ones,
AI is a mystery to most of us.

AI Training

How can we train the essentials of AI?

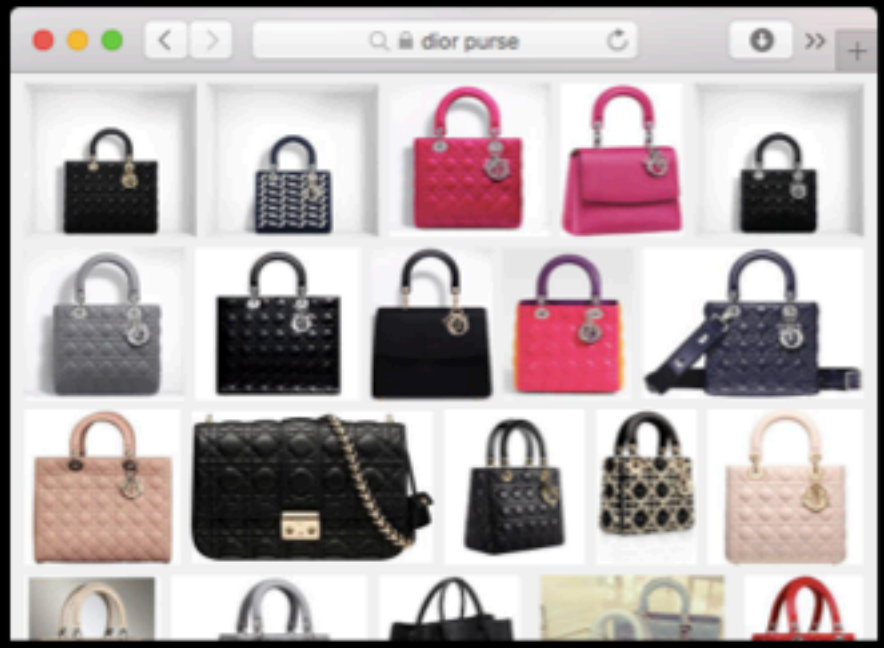
Can we do this within hours? Days? Weeks?

Can we focus on concepts rather than algorithmic details, mathematics, and statistics? Can we train AI without any programming?

Can we teach about AI methods in schools?

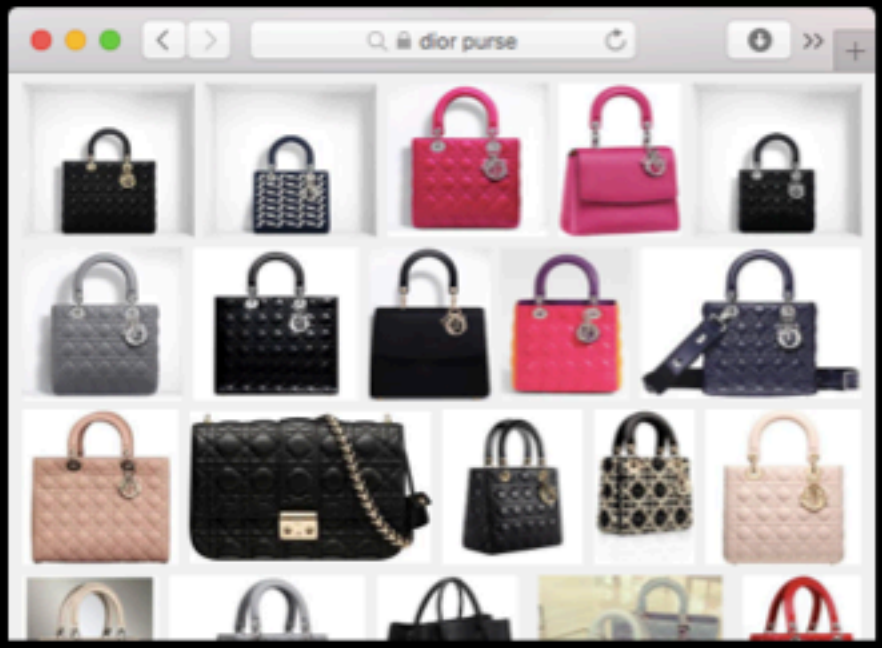
Sara

Sara

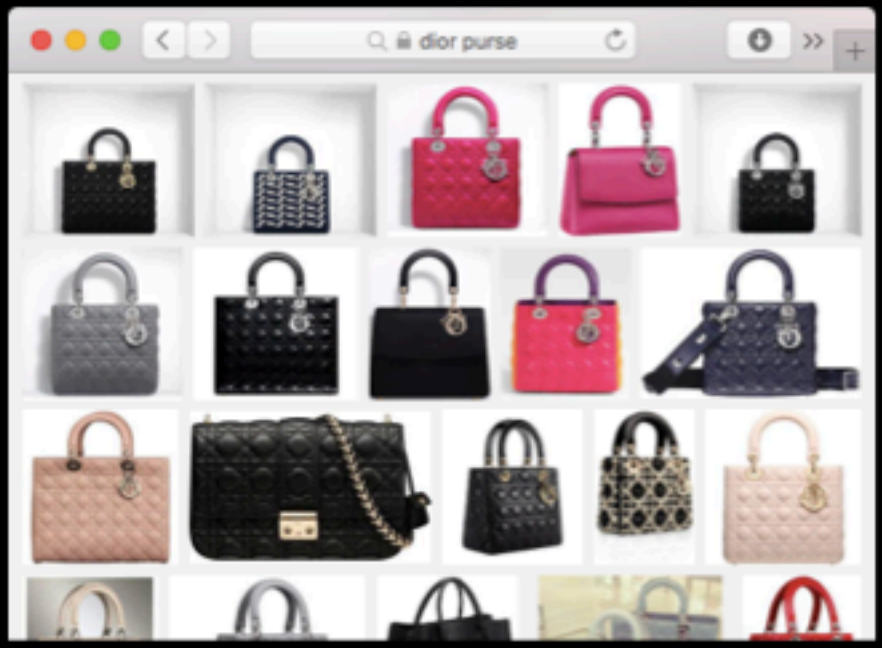

dior purse

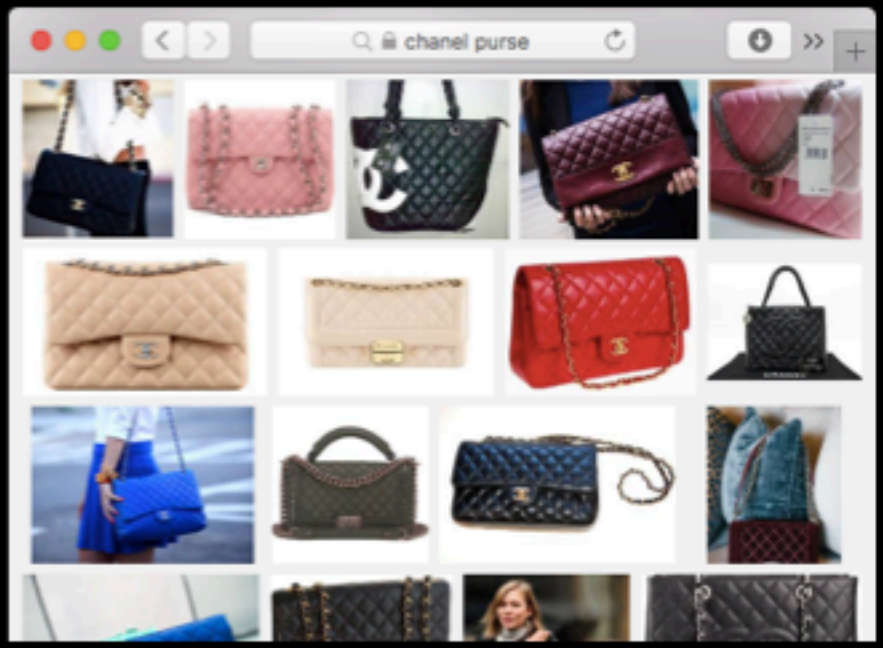

Dior


hermes purse

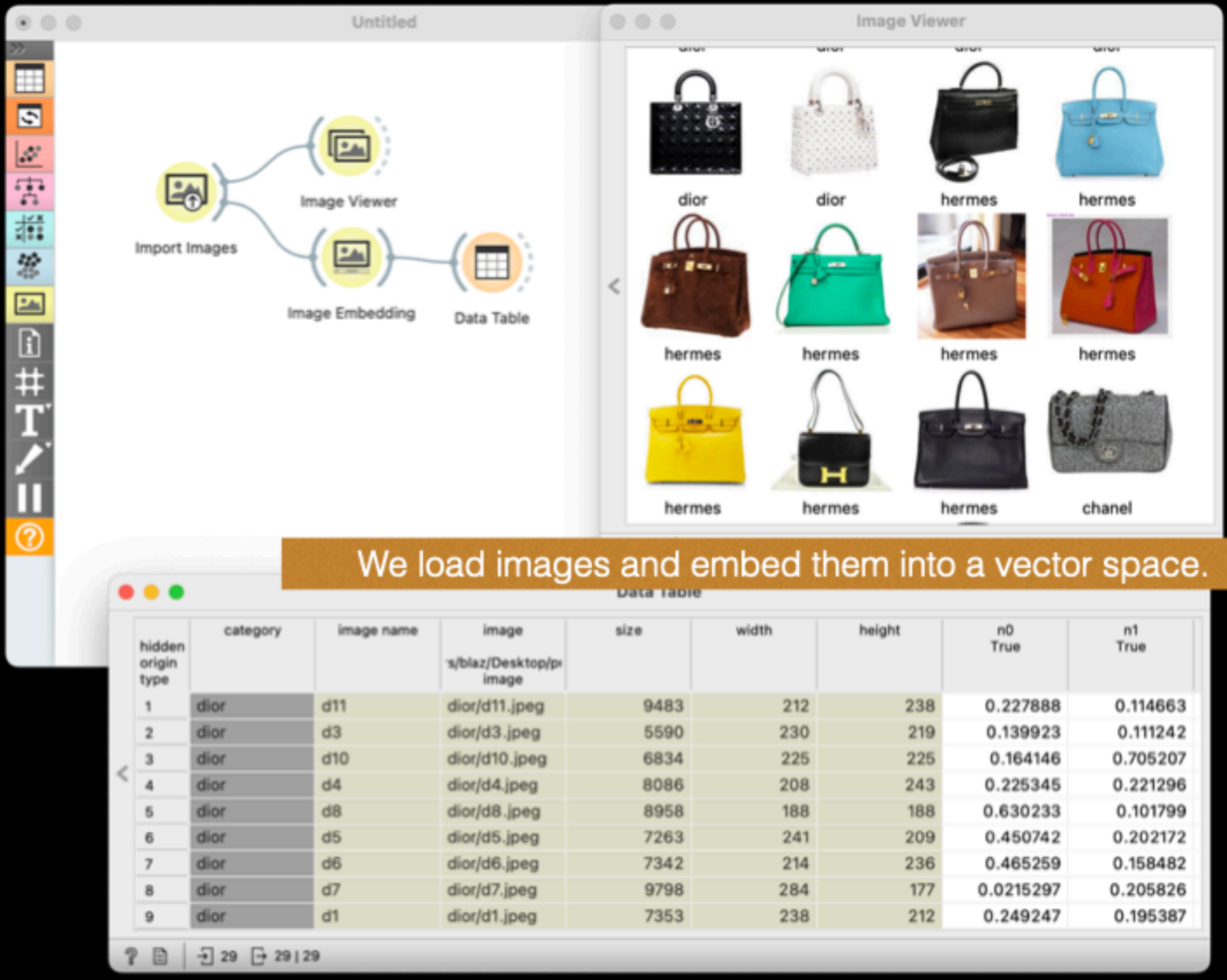

dior purse


hermes purse


dior purse

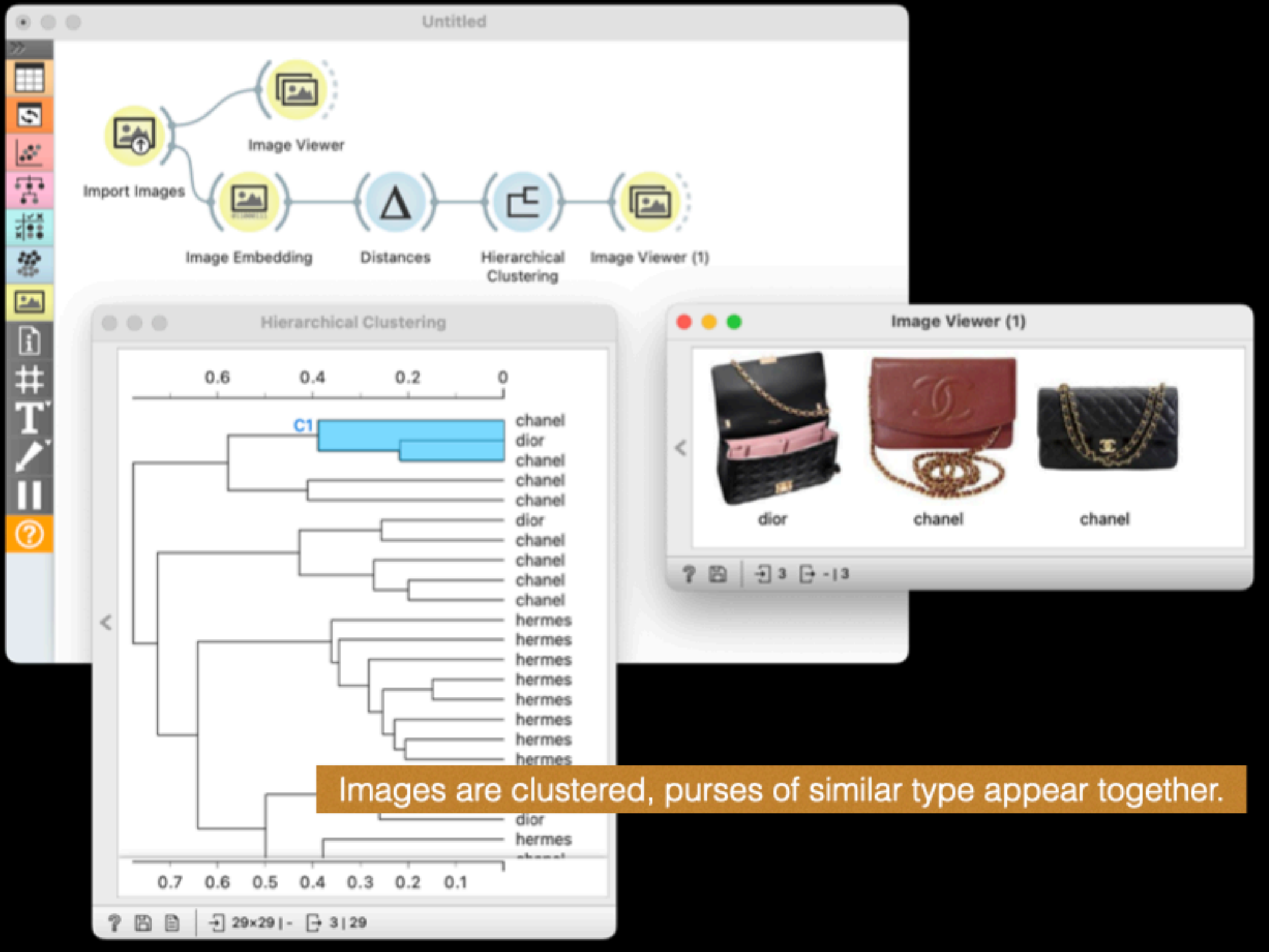

chanel purse

(~15 minute demo starts here)



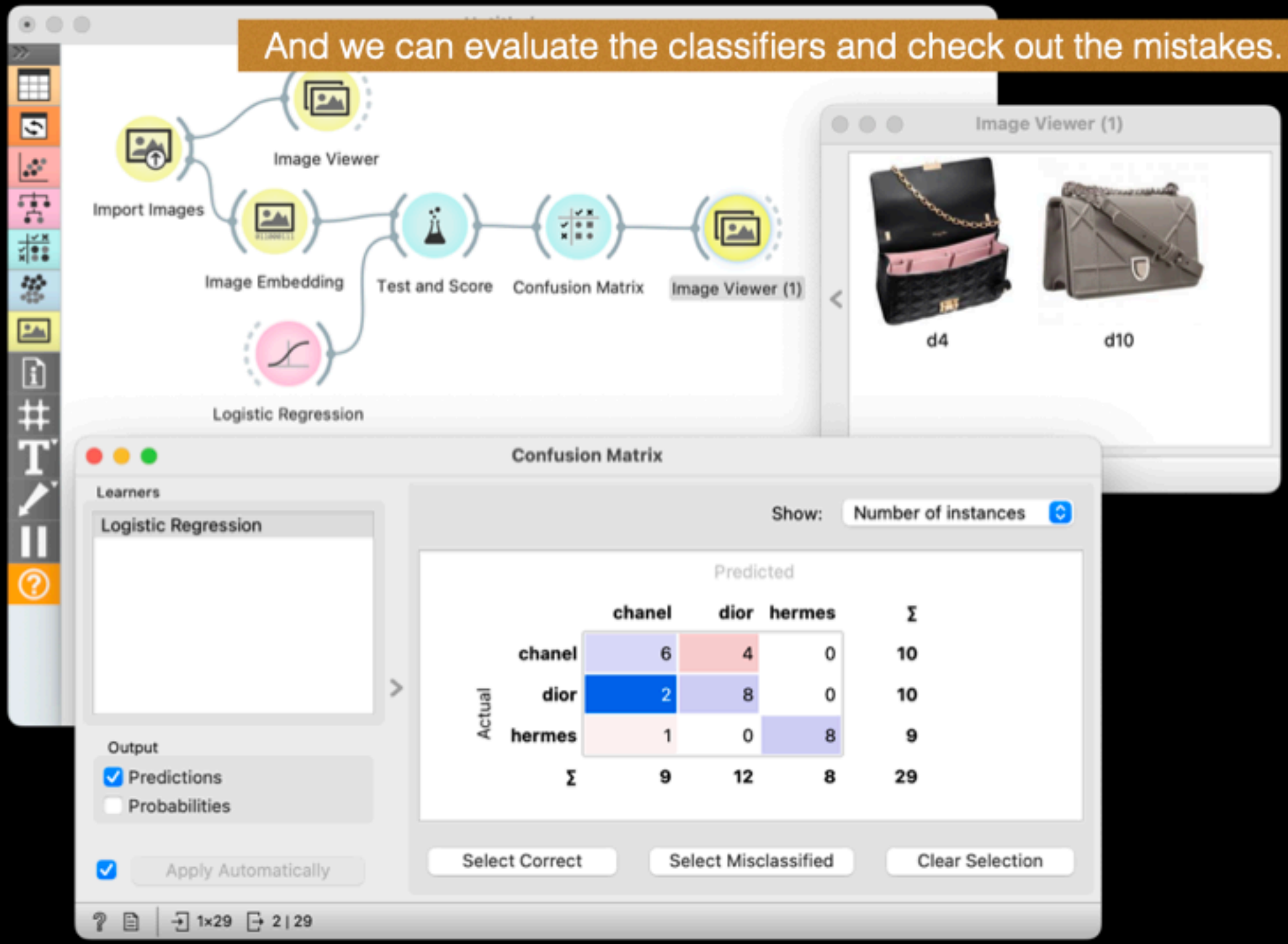
hidden origin type	category	image name	image s/blaz/Desktop/p image	size	width	height	n0 True	n1 True
1	dior	d11	dior/d11.jpeg	9483	212	238	0.227888	0.114663
2	dior	d3	dior/d3.jpeg	5590	230	219	0.139923	0.111242
3	dior	d10	dior/d10.jpeg	6834	225	225	0.164146	0.705207
4	dior	d4	dior/d4.jpeg	8086	208	243	0.225345	0.221296
5	dior	d8	dior/d8.jpeg	8958	188	188	0.630233	0.101799
6	dior	d5	dior/d5.jpeg	7263	241	209	0.450742	0.202172
7	dior	d6	dior/d6.jpeg	7342	214	236	0.465259	0.158482
8	dior	d7	dior/d7.jpeg	9798	284	177	0.0215297	0.205826
9	dior	d1	dior/d1.jpeg	7353	238	212	0.249247	0.195387

29 | 29 | 29


Untitled
Image Viewer
Import Images
Image Embedding
Distances
Hierarchical Clustering
Image Viewer (1)
Hierarchical Clustering
0.6
0.4
0.2
0
C1
chanel
dior
chanel
chanel
chanel
dior
chanel
chanel
chanel
chanel
hermes
hermes
hermes
hermes
hermes
hermes
hermes
hermes
dior
hermes
0.7
0.6
0.5
0.4
0.3
0.2
0.1
29×29 | -
3 | 29
Image Viewer (1)
dior
chanel
chanel
3
- | 3
Images are clustered, purses of similar type appear together.


Untitled
We can build classifiers and guess who designed new purses.
Image Viewer
Import Images
Image Embedding
Logistic Regression
Predictions
Image Viewer (1)
Import Images (1)
Image Embedding (1)
Predictions
Show probabilities for
(None)
Logistic Regression
image name
image
1 chanel
A
A.jpeg
2 dior
C
C.jpeg
3 chanel
B
B.jpeg
4 dior
D
D.jpeg
4 | 0
4 | -
Image Viewer (1)
Image Filename Attribute
image
Title Attribute
Logistic Regression
Image Size
Send Automatically
chanel
dior
chanel
dior
4
- | 4

And we can evaluate the classifiers and check out the mistakes.



Concepts Covered in 15 min

Data representation

Distance estimation

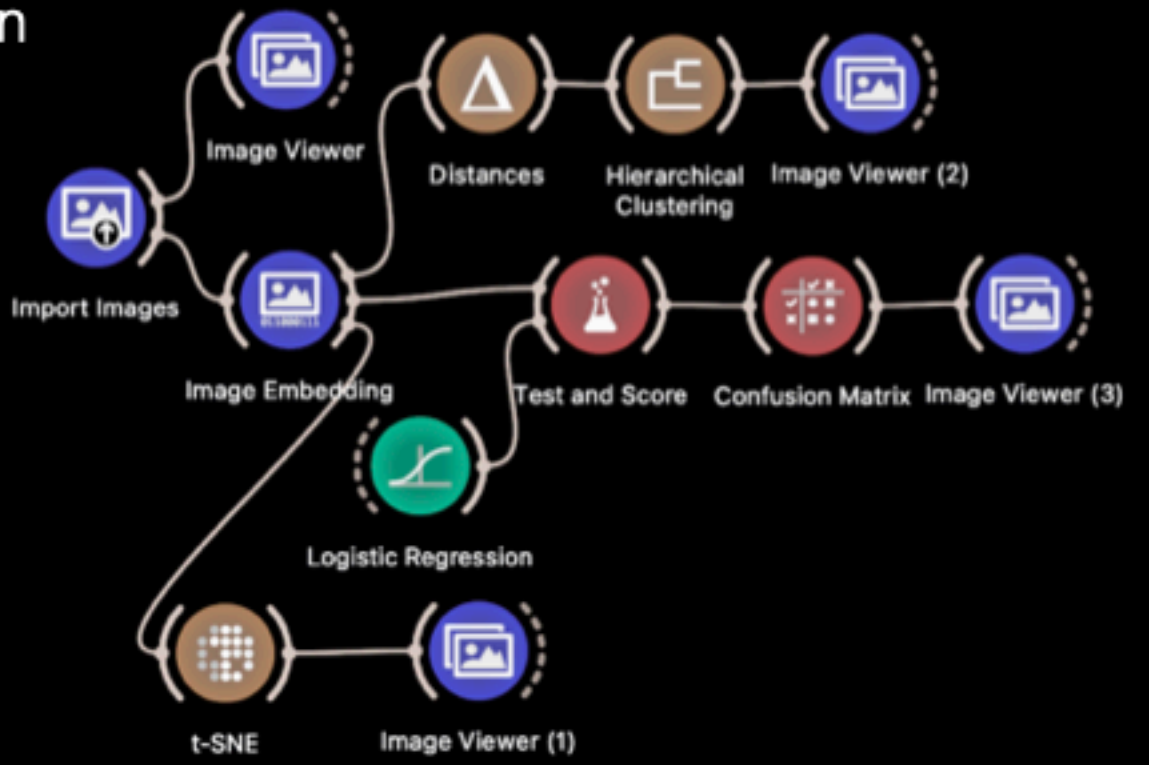
Clustering & Cluster explanation

Image embedding

Classification Models

Classification

Accuracy estimation

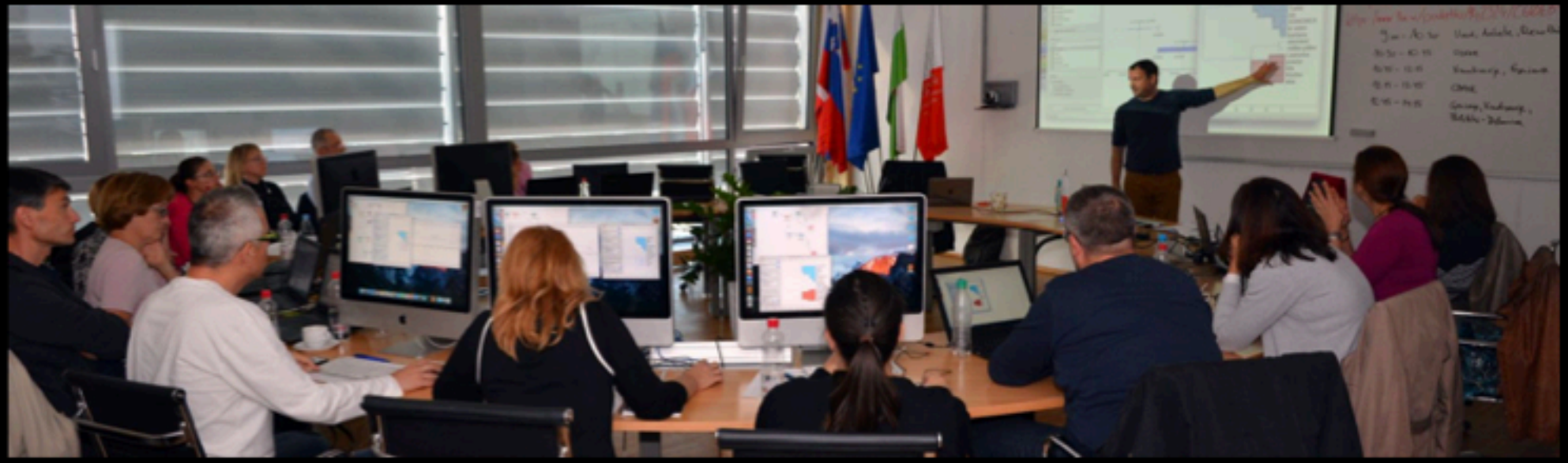


Houston

Kolkata

Pavia

training of public administration



a workshop for telecomm agency

"girls go data mining" workshop

Since 2016, over 150 workshops worldwide.

AI Training

How can we train the essentials of AI?

Can we do this within hours? Days? Weeks?

Can we focus on concepts rather than algorithmic details, mathematics, and statistics? Can we train AI without any programming?

Can we teach about AI methods in schools?

AI Training

How can we train the essentials of AI?

With the right tool. Problem-based. Hands-on. Visualisations. Visual programming.

Can we do th

Can we focus on concepts rather than algorithmic details, mathematics, and statistics? Can we train AI without any programming?

Can we teach about AI methods in schools?

AI Training

How can we train the essentials of AI?

Can we do this within hours? Days? Weeks?

Even one hour of training helps. 10-hour training covers all essential concepts in machine learning at conceptiual level.

Can we fo
details, mathematics, and statistics? Can we train AI without any programming?

Can we teach about AI methods in schools?

AI Training

How can we train the essentials of AI?

Can we do this within hours? Days? Weeks?

Can we focus on concepts rather than algorithmic details, mathematics, and statistics? Can we train AI without any programming?

Yes. We are not training data scientists.

Can we teach about AI methods in schools?

AI Training

How can we train the essentials of AI?

Can we do this within hours? Days? Weeks?

Can we focus on concepts rather than algorithmic details, mathematics, and statistics? Can we train AI without any programming?

Can we teach about AI methods in schools?

Partnership with Google (2021-2023)

Design ten different two-hour workshops

Carry out 40 school workshops

20 elementary and high schools in Slovenia

Train ~1.000 kids

Train teachers, future trainers

Partnership with Google (2021-2023)

Design ten different two-hour workshops

Carry out 40 school workshops

20 elementary and high schools in Slovenia

Train ~1.000 kids

Train teachers, future trainers

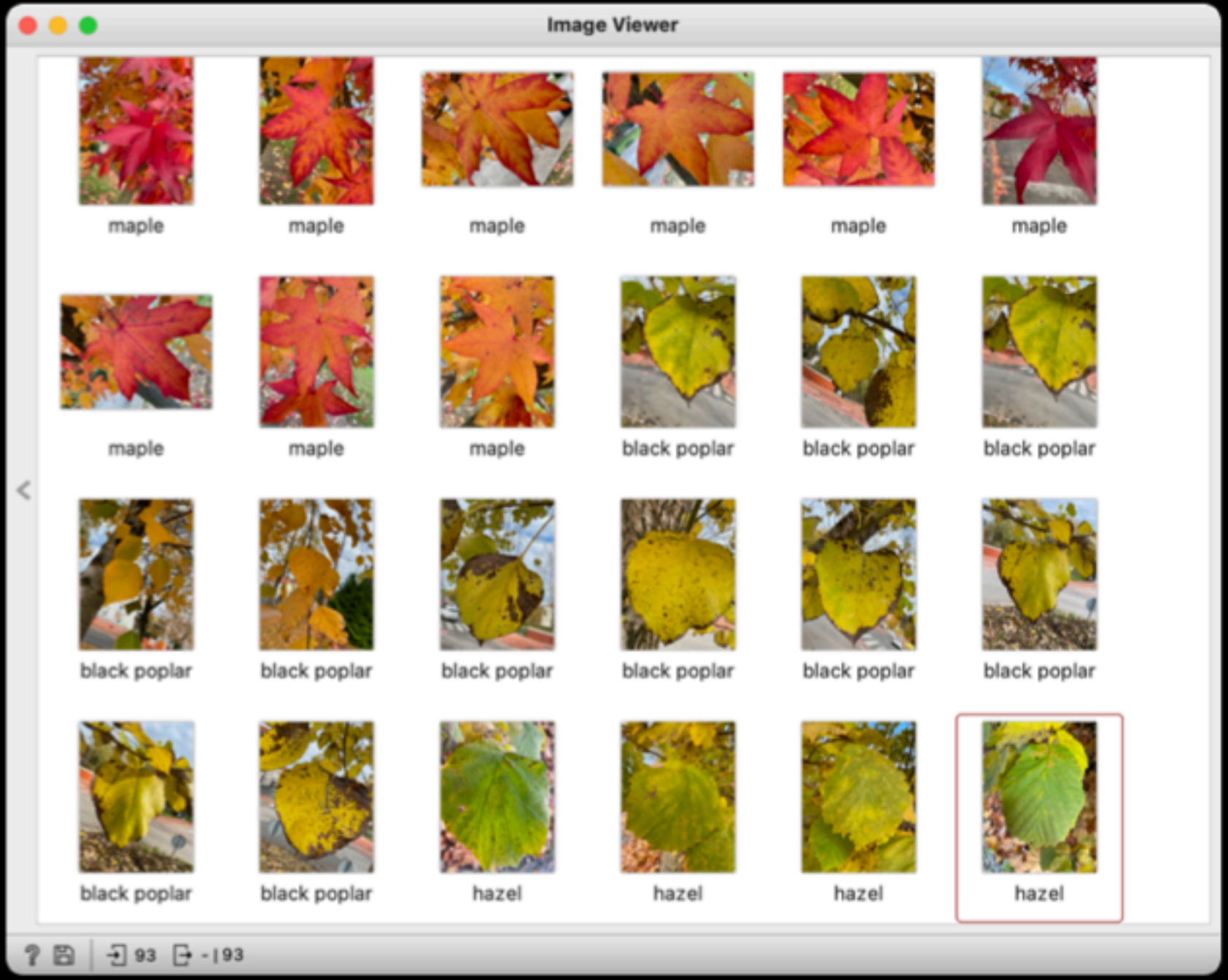
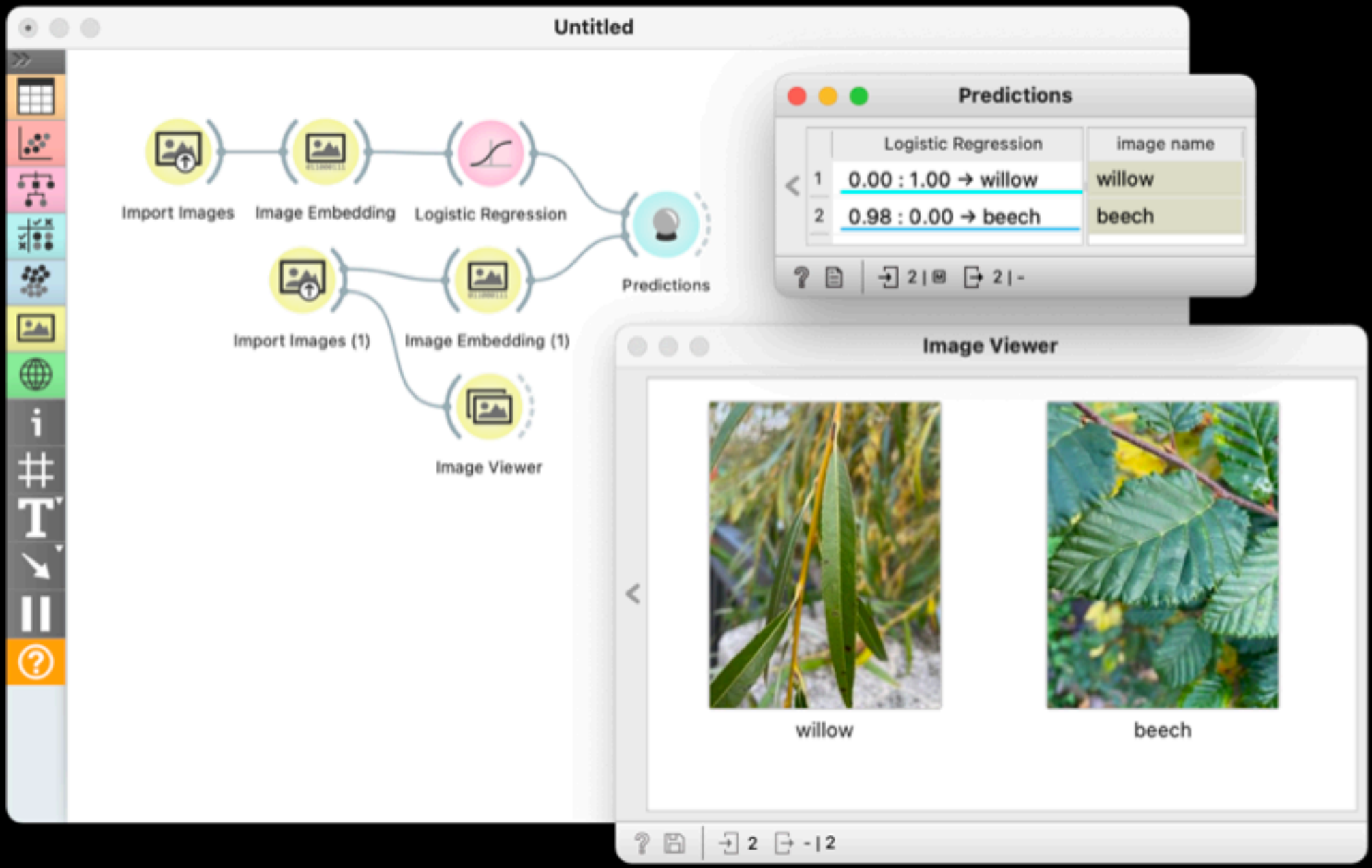
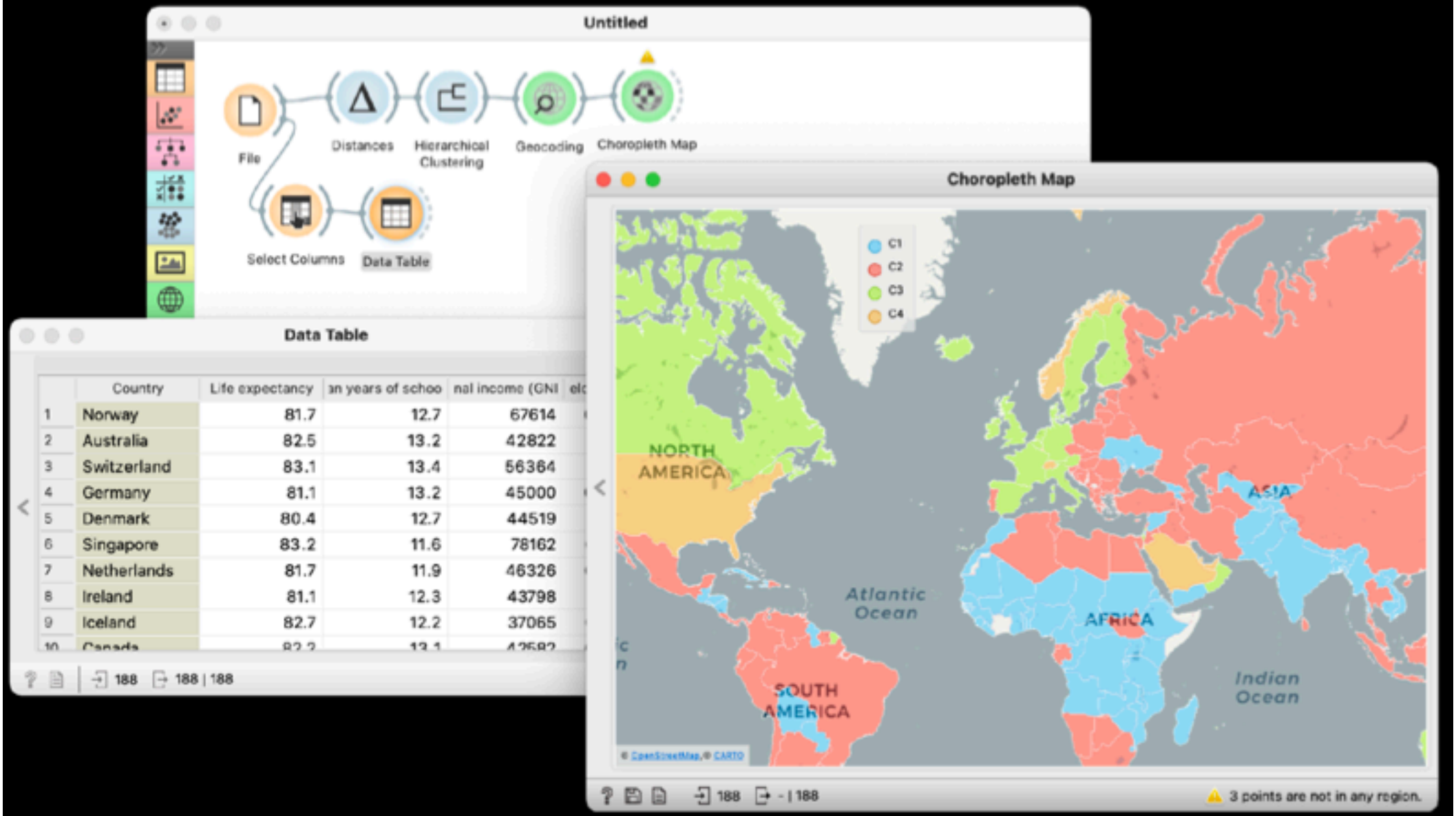
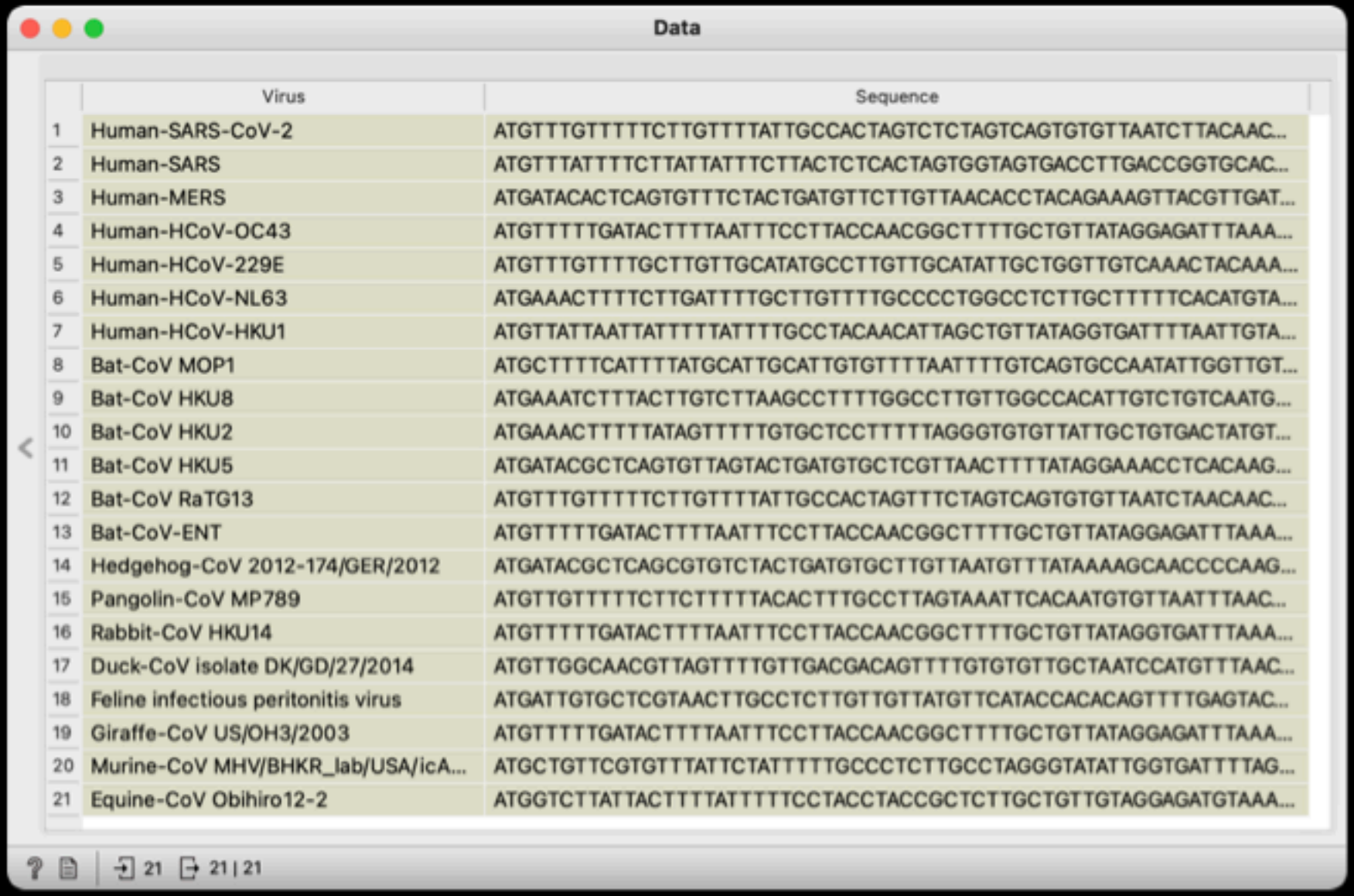
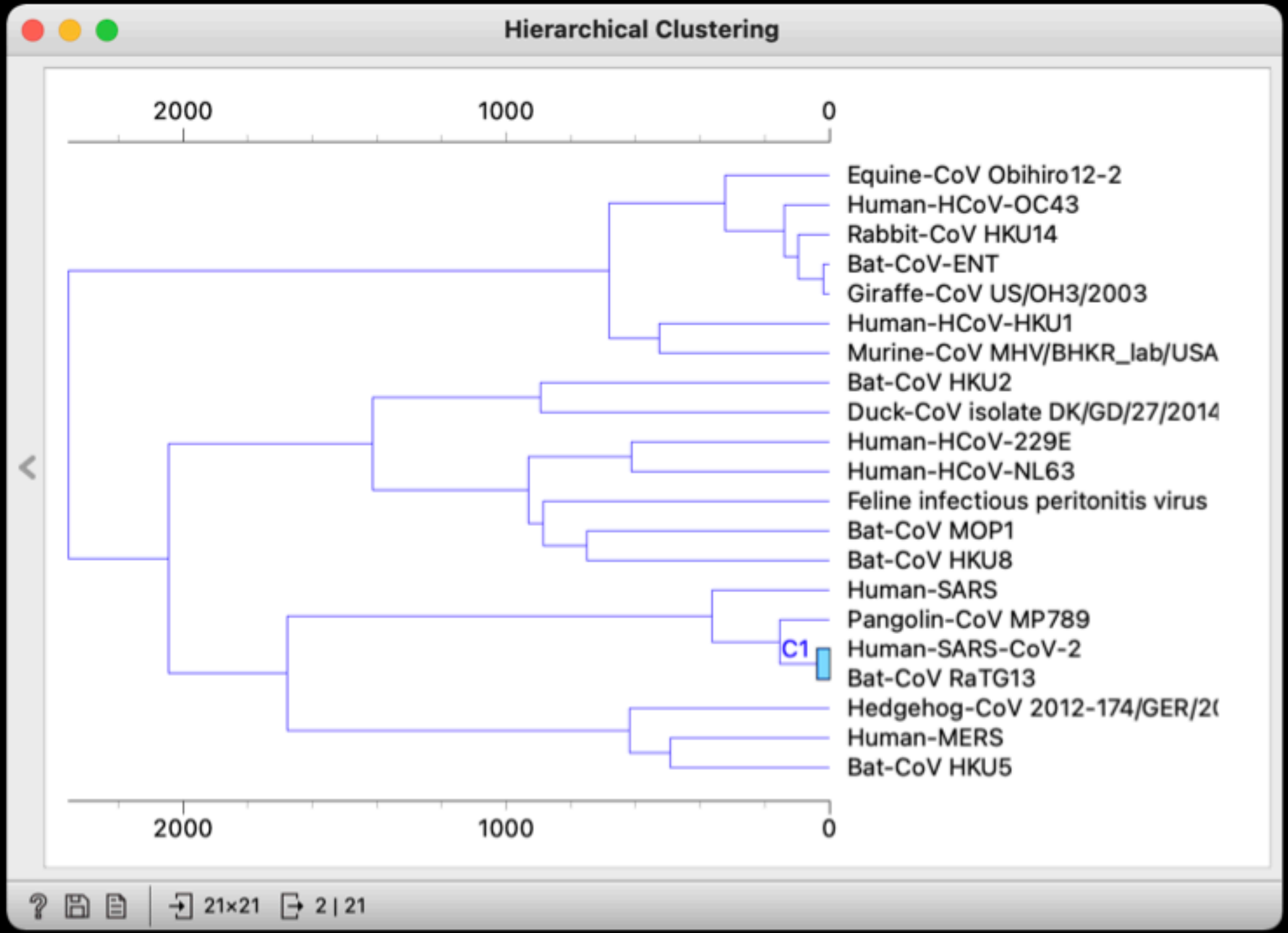


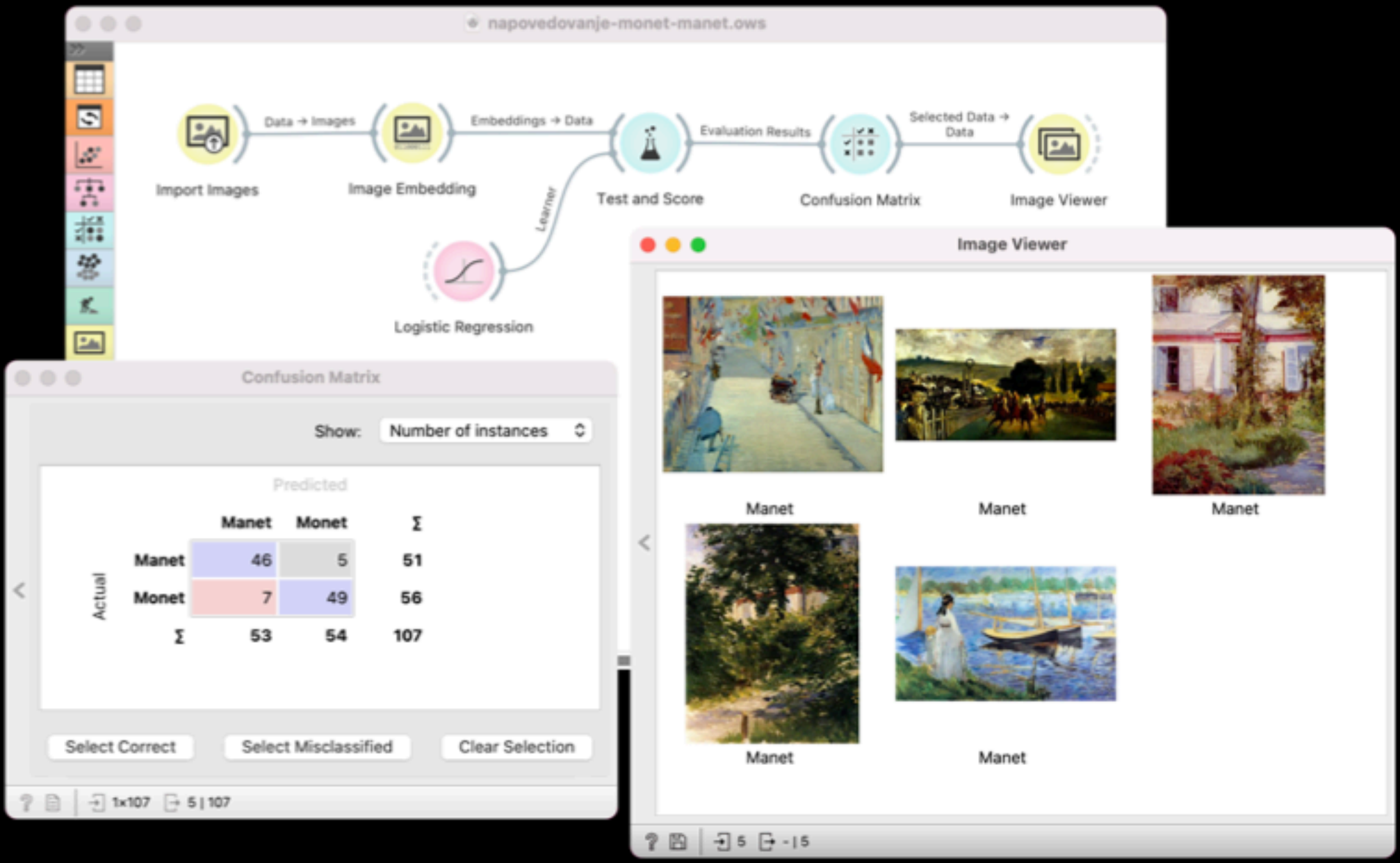
Image Viewer
maple
maple
maple
maple
maple
maple
maple
maple
maple
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
black poplar
hazel
hazel
hazel
hazel
93
-|93

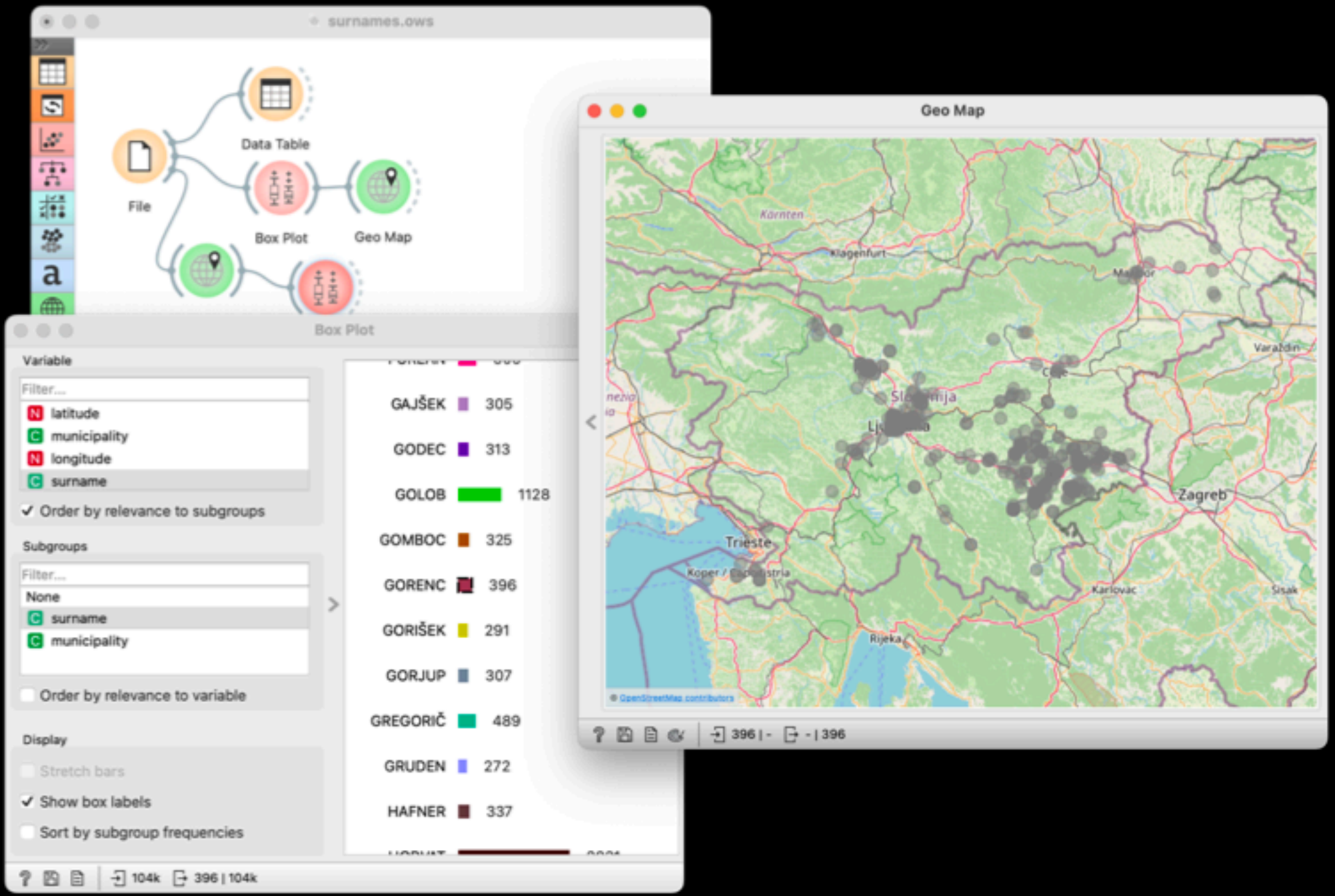

Untitled
Import Images
Image Embedding
Logistic Regression
Predictions
Import Images (1)
Image Embedding (1)
Image Viewer
Predictions
Logistic Regression
image name
1
0.00 : 1.00 → willow
willow
2
0.98 : 0.00 → beech
beech
Image Viewer
willow
beech


Untitled
File
Distances
Hierarchical Clustering
Geocoding
Choropleth Map
Select Columns
Data Table
Data Table
Country
Life expectancy
an years of schoo
nal income (GNI
1 Norway 81.7 12.7 67614
2 Australia 82.5 13.2 42822
3 Switzerland 83.1 13.4 56364
4 Germany 81.1 13.2 45000
5 Denmark 80.4 12.7 44519
6 Singapore 83.2 11.6 78162
7 Netherlands 81.7 11.9 46326
8 Ireland 81.1 12.3 43798
9 Iceland 82.7 12.2 37065
188
188 | 188
Choropleth Map
C1
C2
C3
C4
NORTH AMERICA
ASIA
Atlantic Ocean
AFRICA
SOUTH AMERICA
Indian Ocean
188
- | 188
3 points are not in any region.


Data
Virus
Sequence
1 Human-SARS-CoV-2 ATGTTTGTTTTTCTTGTTTTATTGCCACTAGTCTCTAGTCAGTGTGTTAATCTTACAAC...
2 Human-SARS ATGTTTATTTTCTTATTATTTCTTACTCTCACTAGTGGTAGTGACCTTGACCGGTGCAC...
3 Human-MERS ATGATACACTCAGTGTTTCTACTGATGTTCTTGTTAACACCTACAGAAAGTTACGTTGAT...
4 Human-HCoV-OC43 ATGTTTTTGATACTTTTAATTTCCTTACCAACGGCTTTTGCTGTTATAGGAGATTTAAA...
5 Human-HCoV-229E ATGTTTGTTTTGCTTGTTGCATATGCCTTGTTGCATATTGCTGGTTGTCAAACTACAAA...
6 Human-HCoV-NL63 ATGAAACTTTTCTTGATTTTGCTTGTTTTGCCCCTGGCCTCTTGCTTTTTCACATGTA...
7 Human-HCoV-HKU1 ATGTTATTAATTATTTTTATTTTGCCTACAACATTAGCTGTTATAGGTGATTTTAATTGTA...
8 Bat-CoV MOP1 ATGCTTTTCATTTTATGCATTGCATTGTGTTTTAATTTTGTCAGTGCCAATATTGGTTGT...
9 Bat-CoV HKU8 ATGAAATCTTTACTTGTCTTAAGCCTTTTGGCCTTGTTGGCCACATTGTCTGTCAATG...
10 Bat-CoV HKU2 ATGAAACTTTTTATAGTTTTTGTGCTCCTTTTTAGGGTGTGTTATTGCTGTGACTATGT...
11 Bat-CoV HKU5 ATGATACGCTCAGTGTTAGTACTGATGTGCTCGTTAACTTTTATAGGAAACCTCACAAG...
12 Bat-CoV RaTG13 ATGTTTGTTTTTCTTGTTTTATTGCCACTAGTTTCTAGTCAGTGTGTTAATCTAACAAC...
13 Bat-CoV-ENT ATGTTTTTGATACTTTTAATTTCCTTACCAACGGCTTTTGCTGTTATAGGAGATTTAAA...
14 Hedgehog-CoV 2012-174/GER/2012 ATGATACGCTCAGCGTGTCTACTGATGTGCTTGTTAATGTTTATAAAAGCAACCCCAAG...
15 Pangolin-CoV MP789 ATGTTGTTTTTCTTCTTTTTACACTTTGCCTTAGTAAATTCACAATGTGTTAATTTAAC...
16 Rabbit-CoV HKU14 ATGTTTTTGATACTTTTAATTTCCTTACCAACGGCTTTTGCTGTTATAGGTGATTTAAA...
17 Duck-CoV isolate DK/GD/27/2014 ATGTTGGCAACGTTAGTTTTGTTGACGACAGTTTTGTGTGTTGCTAATCCATGTTTAAC...
18 Feline infectious peritonitis virus ATGATTGTGCTCGTAACTTGCCTCTTGTTGTTATGTTCATACCACACAGTTTTGAGTAC...
19 Giraffe-CoV US/OH3/2003 ATGTTTTTGATACTTTTAATTTCCTTACCAACGGCTTTTGCTGTTATAGGAGATTTAAA...
20 Murine-CoV MHV/BHKR_lab/USA/icA... ATGCTGTTCGTGTTTATTCTATTTTTGCCCTCTTGCCTAGGGTATATTGGTGATTTTAG...
21 Equine-CoV Obihiro12-2 ATGGTCTTATTACTTTTATTTTTCCTACCTACCGCTCTTGCTGTTGTAGGAGATGTAAA...
21
21 | 21


Hierarchical Clustering
2000
1000
0
Equine-CoV Obihiro12-2
Human-HCoV-OC43
Rabbit-CoV HKU14
Bat-CoV-ENT
Giraffe-CoV US/OH3/2003
Human-HCoV-HKU1
Murine-CoV MHV/BHKR_lab/USA
Bat-CoV HKU2
Duck-CoV isolate DK/GD/27/2014
Human-HCoV-229E
Human-HCoV-NL63
Feline infectious peritonitis virus
Bat-CoV MOP1
Bat-CoV HKU8
Human-SARS
Pangolin-CoV MP789
C1
Human-SARS-CoV-2
Bat-CoV RaTG13
Hedgehog-CoV 2012-174/GER/2(
Human-MERS
Bat-CoV HKU5
2000
1000
0
21×21
2 | 21


napovedovanje-monet-manet.ows
Data → Images
Embeddings → Data
Evaluation Results
Selected Data → Data
Learner
Import Images
Image Embedding
Test and Score
Confusion Matrix
Image Viewer
Logistic Regression
Confusion Matrix
Show:
Number of instances
Predicted
Manet
Monet
Σ
Actual
Manet
46
5
51
Monet
7
49
56
Σ
53
54
107
Select Correct
Select Misclassified
Clear Selection
1×107
5 | 107
Image Viewer
Manet
Manet
Manet
Manet
Manet
5
- | 5


surnames.ows
Data Table
File
Box Plot
Geo Map
Box Plot
Variable
Filter...
latitude
municipality
longitude
surname
Order by relevance to subgroups
Subgroups
Filter...
None
surname
municipality
Order by relevance to variable
Display
Stretch bars
Show box labels
Sort by subgroup frequencies
GAJŠEK 305
GODEC 313
GOLOB 1128
GOMBOC 325
GORENC 396
GORIŠEK 291
GORJUP 307
GREGORIČ 489
GRUDEN 272
HAFNER 337
104k
396 | 104k
Geo Map
Kärnten
Klagenfurt
Varaždin
Zagreb
Trieste
Koper / Capodistria
Karlovac
Sisak
Rijeka
396 | -
- | 396

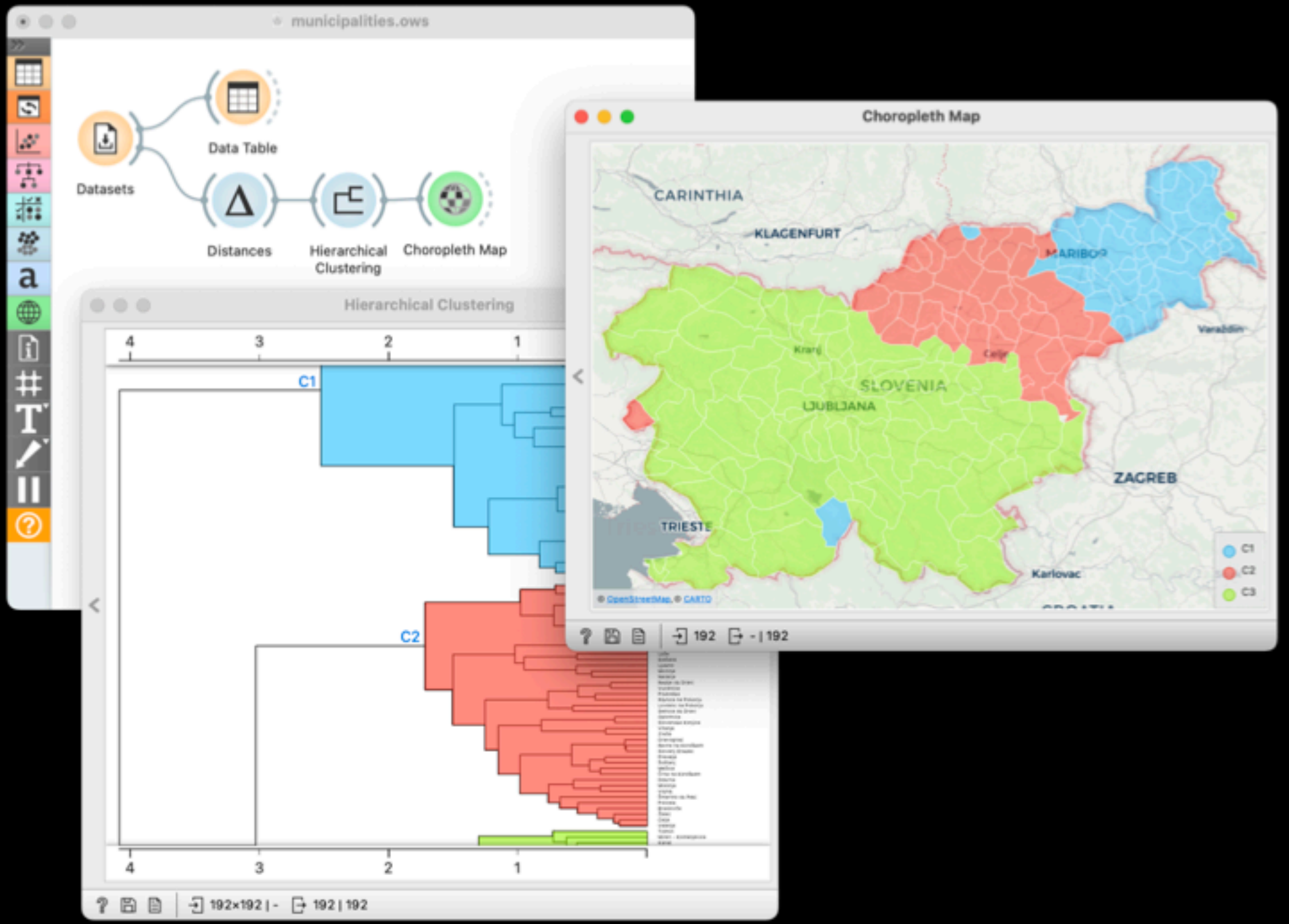

municipalities.ows
Data Table
Datasets
Distances
Hierarchical Clustering
Choropleth Map
Hierarchical Clustering
C1
C2
4
3
2
1
192×192 | -
192 | 192
Choropleth Map
CARINTHIA
KLAGENFURT
MARIBOR
SLOVENIA
LJUBLJANA
ZAGREB
TRIESTE
Karlovac
C1
C2
C3
192
- | 192


Image Viewer
regulatory
warning
yield
STOP
CARINA
DOUANE
POLICIJA
POLICE
CESTNINA
PEAGE
40
70
- | 70


Untitled
Import Images
Image Viewer
Image Embedding
Silhouette Plot
Image Viewer (1)
Image Viewer (1)
STOP
warning
warning
warning
3
-|3
Silhouette Plot
-0.1
0
0.1
0.2
0.3
regulatory (19)
warning (28)
yield (23)
70
3|70

pumice.si

Home About us News Lesson Plans Gallery Contact

Lessons with a dash of artificial intelligence

Enriching lessons with content on artificial intelligence

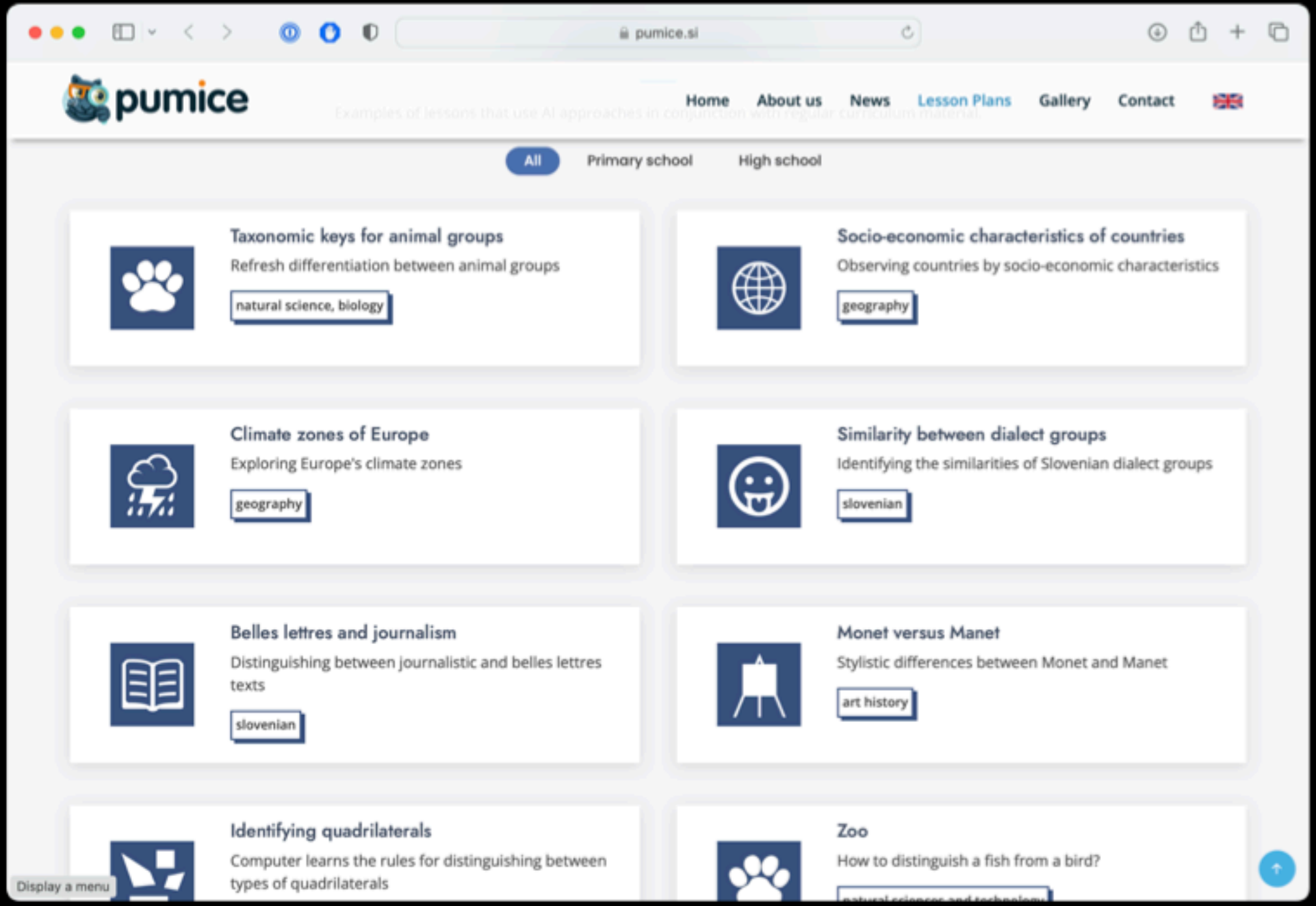
Lesson Plans

ABOUT US

Where do Wolves and Badgers live in Slovenia? Does Monet paint water motifs or is it Manet? Can artificial intelligence recognise when a politician is telling the truth? Is the oak the only tree with fan leaves? Did SARS-CoV-2 really jump off a bat and if so, when? Does the number of years spent in

The Pumice project develops educational activities that can be used to enrich different school subjects. We use data related to the subject matter and explore it using AI and machine learning approaches. In collaboration with teachers, we have developed learning templates and background

Display a menu


pumice.si
pumice
Home
About us
News
Lesson Plans
Gallery
Contact
All
Primary school
High school
Taxonomic keys for animal groups
Refresh differentiation between animal groups
natural science, biology
Socio-economic characteristics of countries
Observing countries by socio-economic characteristics
geography
Climate zones of Europe
Exploring Europe's climate zones
geography
Similarity between dialect groups
Identifying the similarities of Slovenian dialect groups
slovenian
Belles lettres and journalism
Distinguishing between journalistic and belles lettres texts
slovenian
Monet versus Manet
Stylistic differences between Monet and Manet
art history
Identifying quadrilaterals
Computer learns the rules for distinguishing between types of quadrilaterals
Zoo
How to distinguish a fish from a bird?
Display a menu

Partnership with Google (2021-2023)

Design ten different two-hour workshops

Carry out 40 school workshops

20 elementary and high schools in Slovenia

Train ~1.000 kids

Train teachers, future trainers

Janez Demšar in primary schools
Also thanks to Google.org/Tides fundation

Partnership with Google (2021-2023)

Design ten different two-hour workshops

Carry out 40 school workshops

20 elementary and high schools in Slovenia

Train ~1.000 kids

Train teachers, future trainers

STEM teachers training in Houston, USA (June 2023)
An National Science Foundation Project

Partnership with Google (2021-2023)

Design ten different two-hour workshops

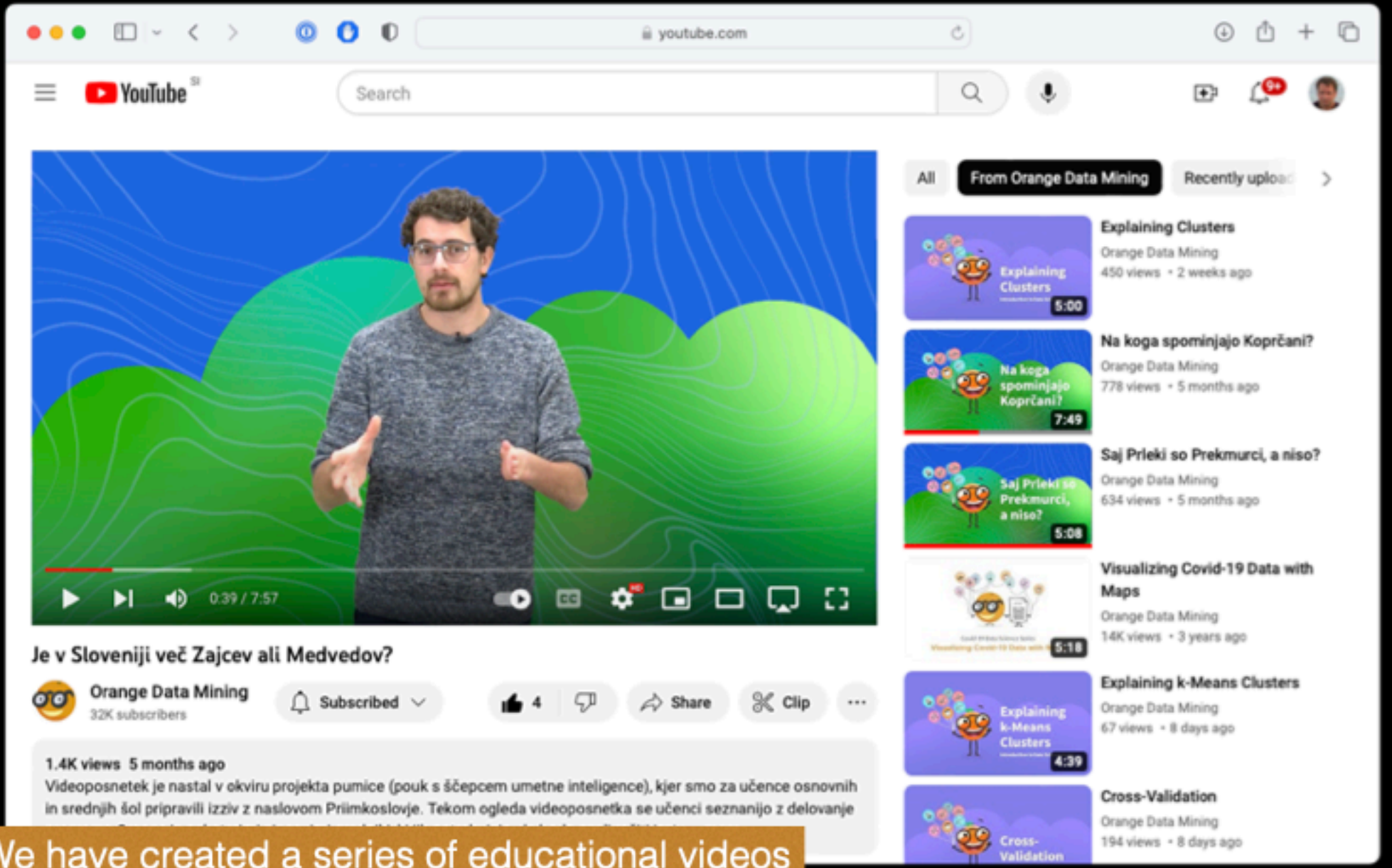
Carry out 40 school workshops

20 elementary and high schools in Slovenia

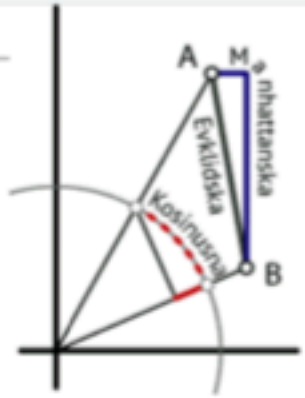
Train ~1.000 kids

Train teac

Change of approach: prepare training videos for kids, train teachers (so they know what is happening), prepare quizzes and written material, run the challenge.



We have created a series of educational videos for children and teachers.



Geometrijska razlaga: Evklidska razdalja gre naravnost, Manhattanska gre okrog vogalov, kot v mestih s pravokotnim tlorisom ulic, kosinusna pa opazuje, pod kakšnim kotom vidimo točki.

izstopajoče vrednosti, Mahalanovisova se obnese pri koreliranih spremenljivkah in Hammingova pri binarnih, Jaccardova pri spremenljivkah, ki označujejo pripadn... Pravzaprav nas tule niti ne zanima. Oprostite, ker sem načel temo. :)

Za naše podatke je najprimernejša kosinusna razdalja. Ta bo dve občini prepoznala kot podobni, če imata podobno mešanico priimkov, ne glede na to, da imata morda zelo različno število prebivalcev. Za razliko od nje bi Evklidska razdalja opazila predvsem razliko v številu prebivalcev.

Gradnik torej prejme tabelo podatkov in med vsakim parom vrstic (ali stolpcev, če bi ga nastavili tako, vendar ga ne bomo) izračuna razdaljo po izbrani definiciji.

Izhod iz gradnika ni tabela podatkov temveč matrika razdalj. Zato nanj ne moremo pripeti nobenega od gradnikov, ki smo jih spoznali v prvem delu, saj ti ne prejemajo takšnih vrst podatkov.

Matrika razdalj

Matriko razdalj pokaže istoimenski gradnik (Distance Matrix). V tej aktivnosti ga ...o, kakšno reč sestavijo Razdalje.

...matrika razdalj. Tabel, s kakršnimi smo delali v

We have written a lecture notes that explain the challenge and background. For dedicated teachers only.

Gradnik se trudi sam uganiti primerno oznako za vrstice in stolpce – v tem primeru imena občin. Če mu ne uspe, jo (spodaj levo) izberemo sami.

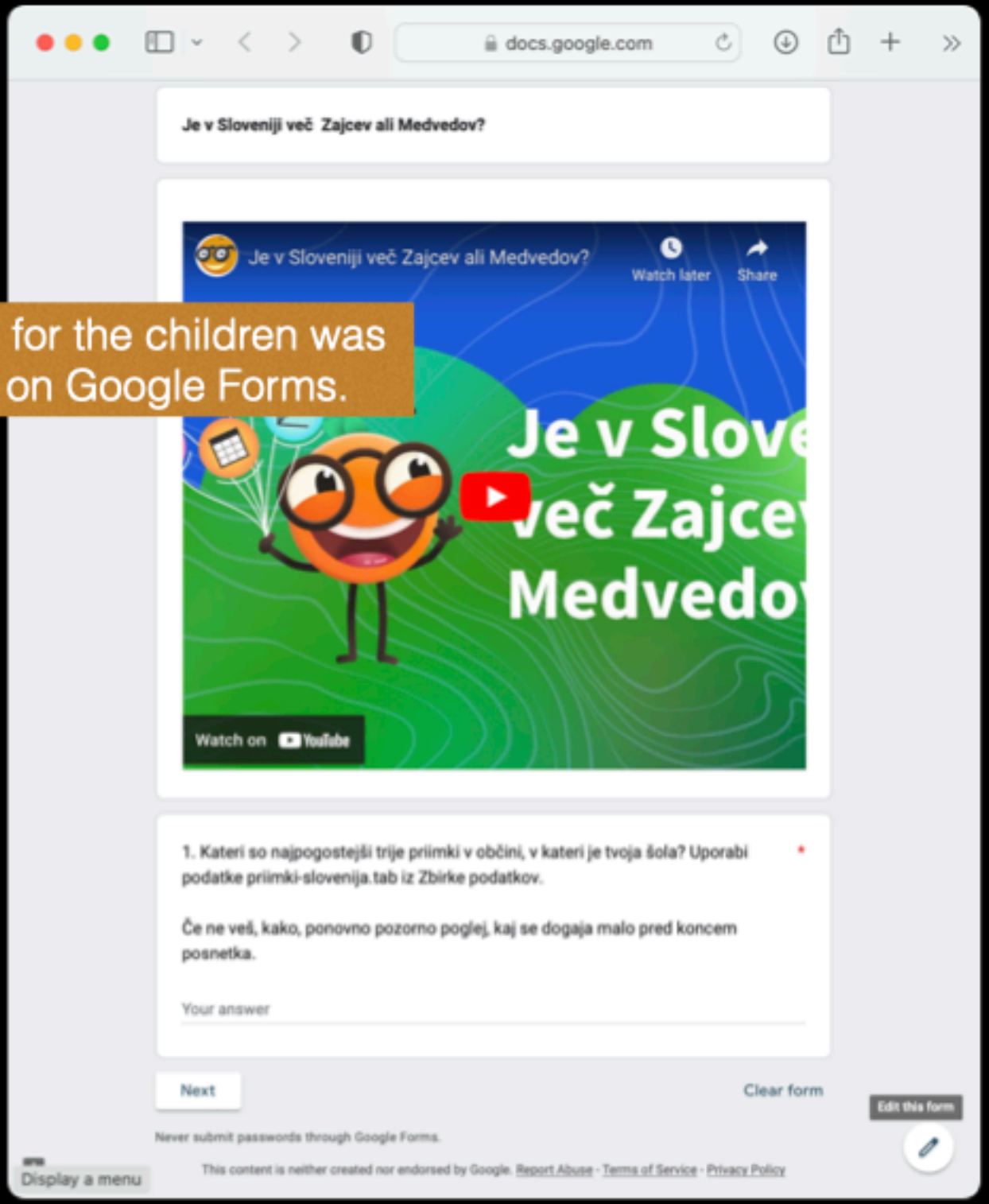
Celjski priimki niso zelo različni od hrastniških (razdalja je 0.378) (podobni so si celo bolj kot brezoviški in ižanski!). Prav nič pa

Matrika razdalj

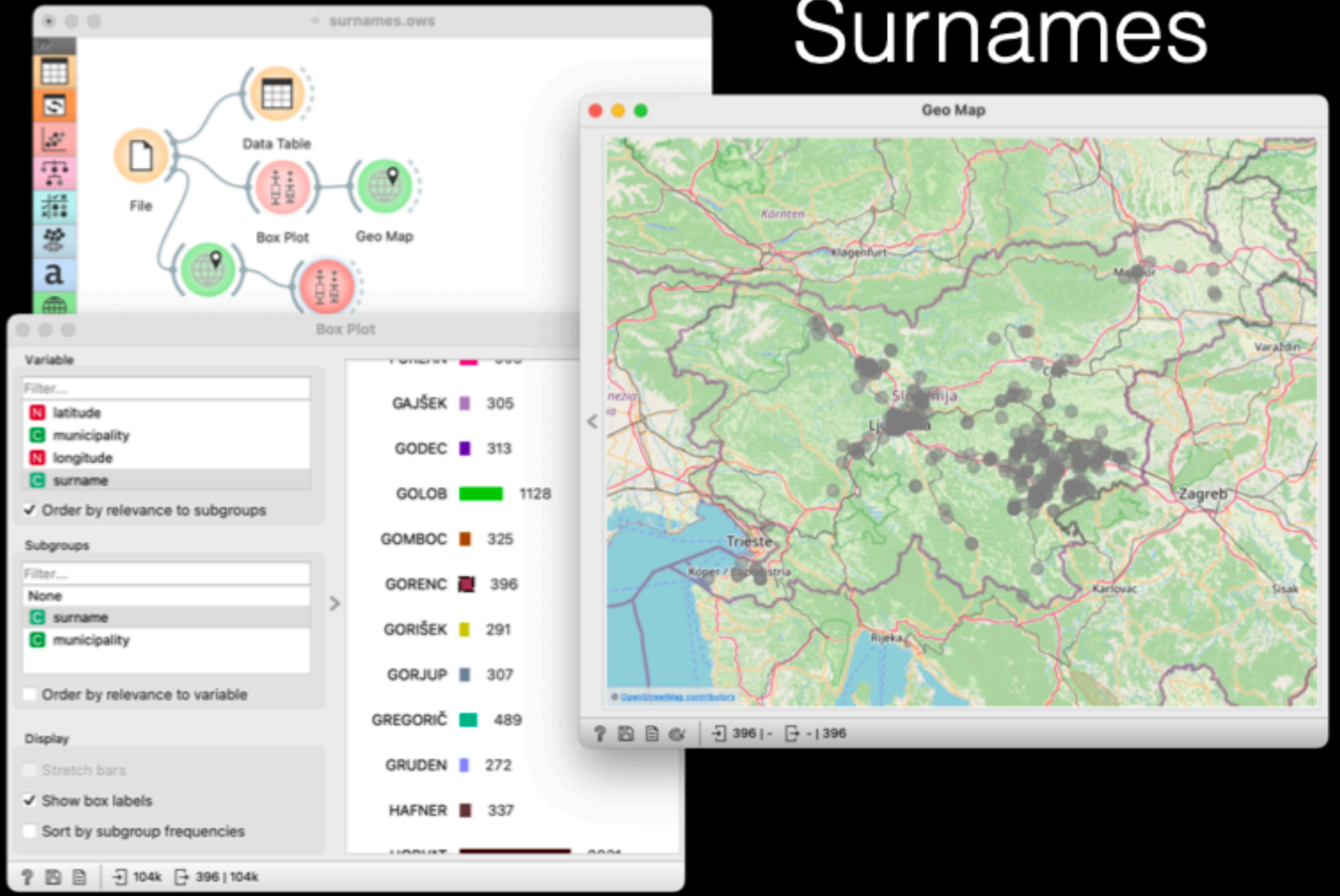
	Horjul	Hrastnik	Hrpelje - Kozina	Idrija	Ig	Ilirska Bistrica	Ivančna Gorica
Brda	0.971	0.941	0.870	0.918	0.841	0.794	0.913
Brezovica	0.634	0.634	0.676	0.677	0.459	0.632	0.615

We have trained the teachers about machine learning and went through the challenge.

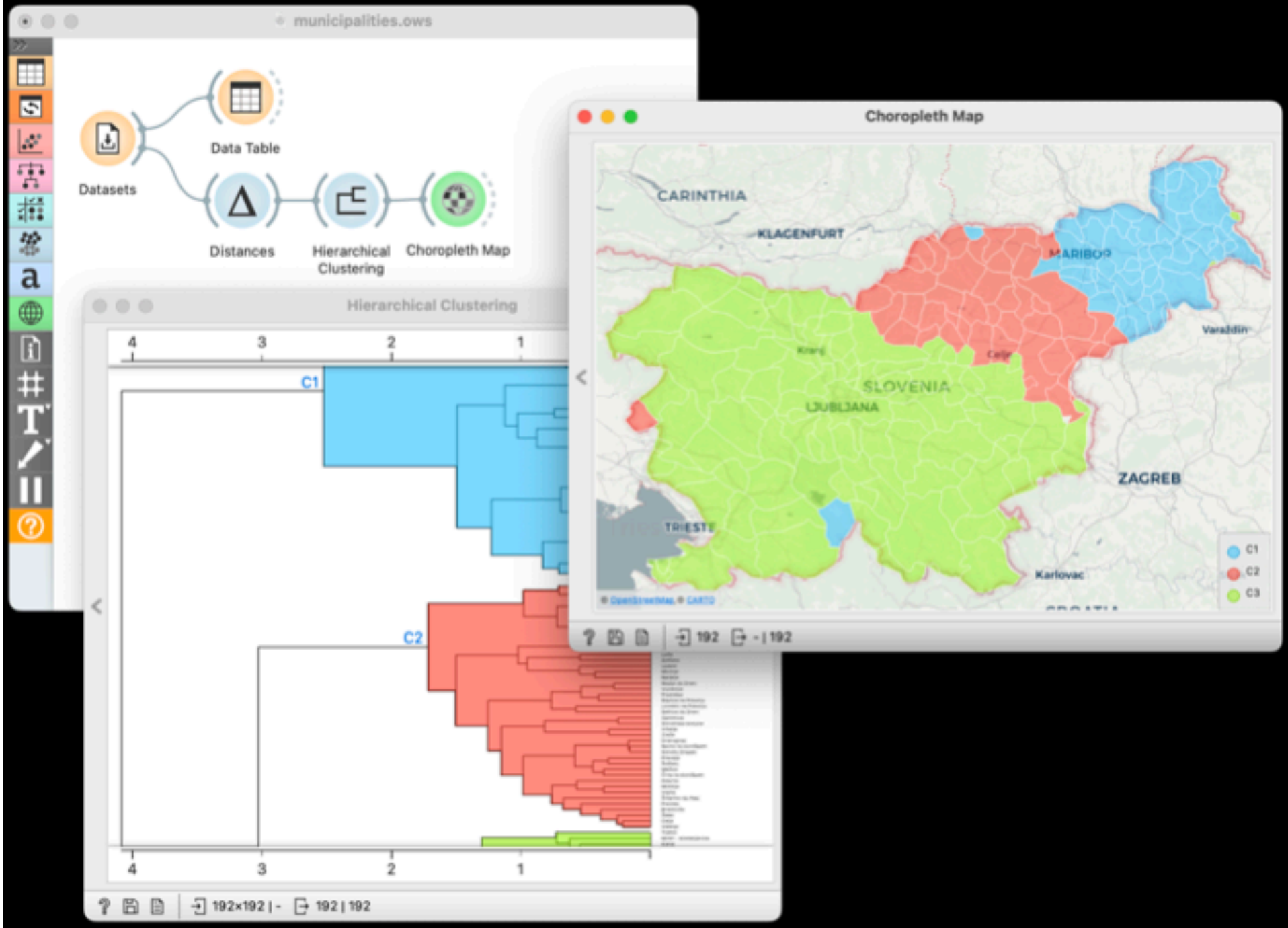
The challenge for the children was then posted on Google Forms.



Challenge: Surnames



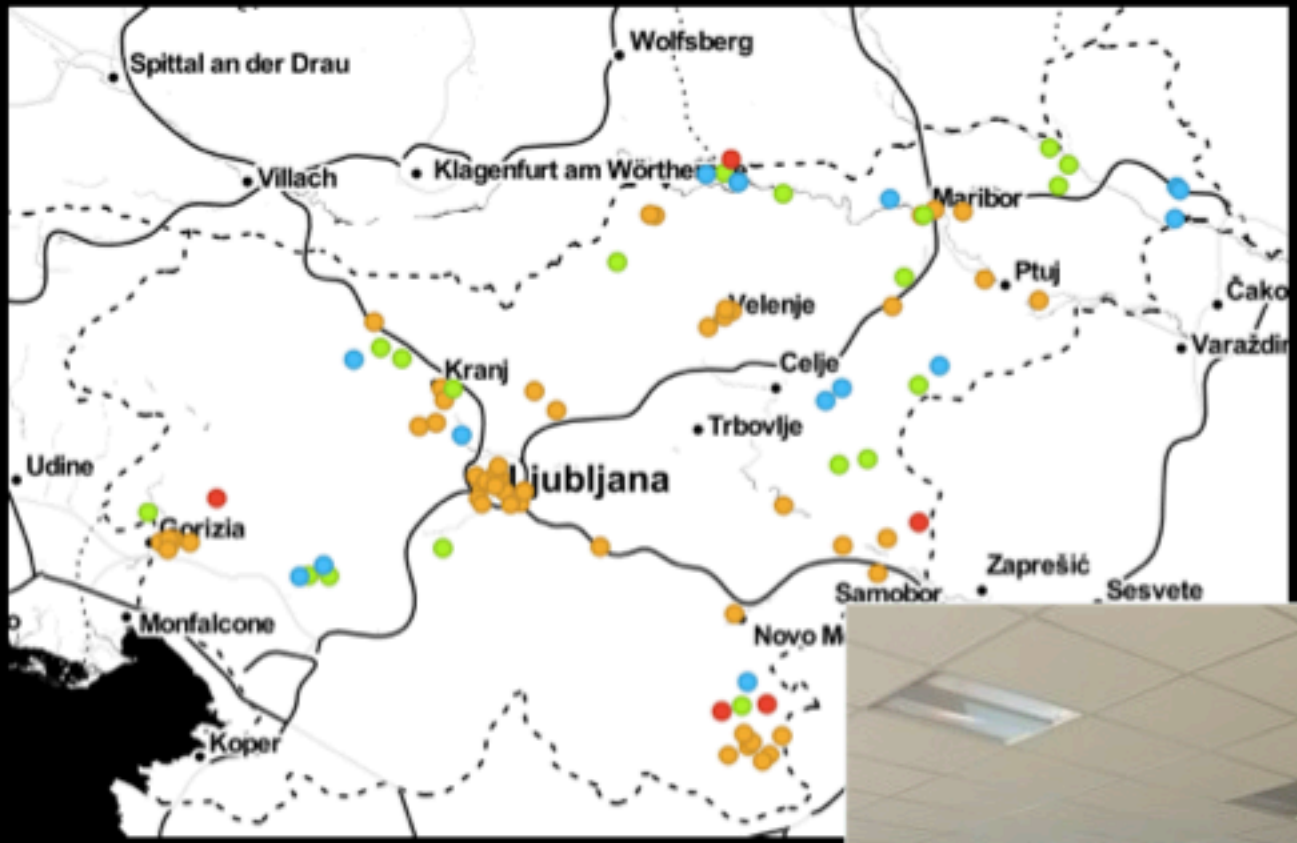
Showcase: Surname-Based Profiling

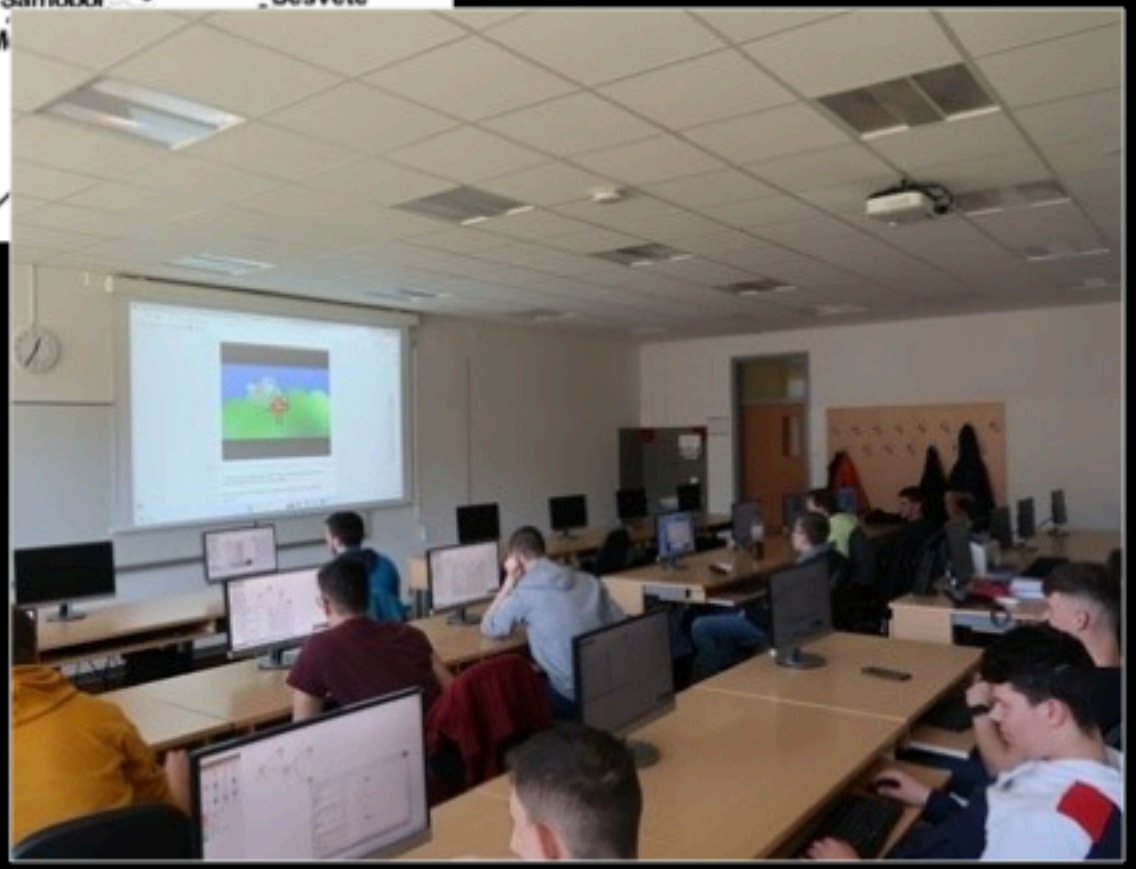


Concepts Covered

- Data
- Data-based profiling
- Estimation of distance
- Nearest neighbors
- Hierarchical clustering
- Geoinformatics

The challenge, while only an hour long, covers many important machine learning concepts.





Classes that carried out the training:

Language
History
Geography

May 2023, 1.000 school kids, 50 schools

Lessons Learned

Visual analytics and visual programming helps

Teachers can't train AI on their own

We need a better mini-MOOC environment

We need thorough evaluation

App should run on the web

Lessons Learned

Visual analytics and visual programming helps

Teache
own

We need a better mini-MOOC environment

We need thorough evaluation

App should run on the web

We know. This is why we have build Orange Data Mining. It is freem intuitive, with great visualisations. :)

Lessons Learned

Visual analytics and visual programming helps

Teachers can't train AI on their own

We nee
environment

We need thorough evaluation

App should run on the web

But we still need to train them. End we collaborate with them in design of the lectures. Great teachers are cornerstone of any training.

Lessons Learned

Visual analytics and visual programming helps

Teachers can't train AI on their own

We need a better mini-MOOC environment

We need thorough evaluation

App should run on the web

Done. After a year of work.

Ljudje naj bi razlikovali med 10 milijoni različnih barv. Praktične izkušnje kažejo, da jih od tega moški prepoznajo 5-6, ženske pa ostalih 9999995. Znanost pritrjuje: ženske so v razlikovanju barv dokazano boljše od moških ($p<0.001$).

Dragi bralec! Če ste moškega spola, se vrnite v Porazdelitve in povečajte širino koša na 5. (Če ste ženska, storite enako. Tako boste videli svet skozi moške oči in nas naslednjič v trgovini z oblekami lažje razumele. Hvala.)

Our mini-MOOC mixes the text, images, videos, quizzes. It is simple to construct the concent (markdown) and supports various modes of analysis of results.

Toliko o drugi tabeli. Pa tretja? Pomen te pa odkrijte sami. (Nasvet: ne pošljite je v Barvni zemljevid temveč v Tabelo. Spremenite širino koša nazaj na, recimo, 2.)

Tretja tabela, Podatki o porazdelitvi, vsebuje dva stolpca. Če vemo, kaj pomenita, lahko brez seštevanja odgovorimo na vprašanje, kakšna je vsota vrednosti v drugem. Kakšna?

Submit

Pokaži odgovor

Lessons Learned

Visual analytics and visual programming helps

Teachers can't train AI on their own

We need a better mini-MOOC environment

We need thorough evaluation

App should run on the web

This is hard. But in plan. Our Erasmus+ project with Ireland and Luxemburg starts in January 2024.

Thanks to…

Margit Pollek and eEducation Fachtagung Linz

Over 20 members of Bioinformatics Lab at the Faculty of Computer and Information Science, University of Ljubljana

Our current sponsors: Slovene Research Agency, Ministry for Public Administration, Chan Zuckerberg Initiative, Google.org, EU ARISA and Erasmus+

orangedatamining.com

pumice.si/en

http://youtube.com/orangedatamining

bzupan@gmail.com