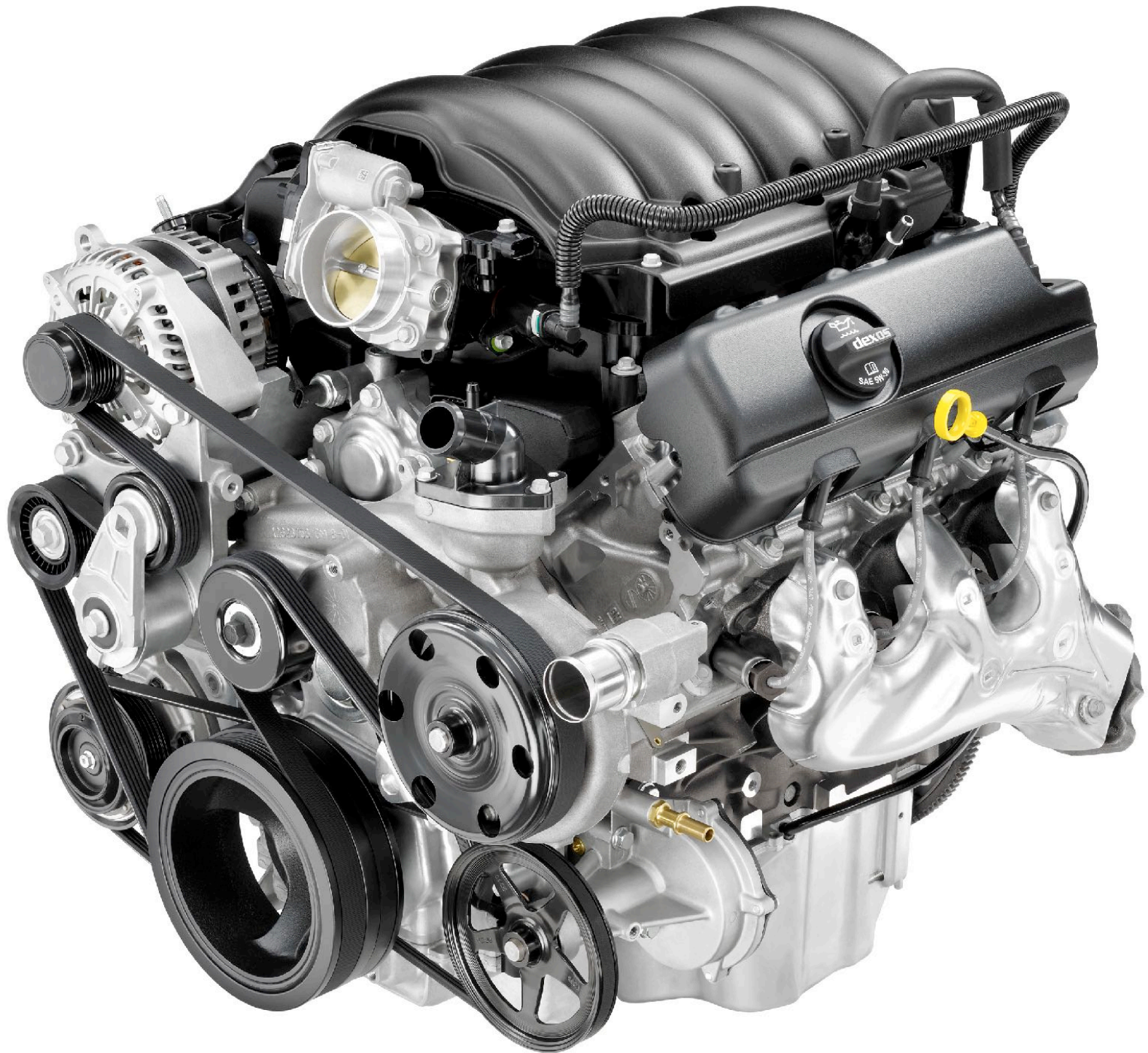
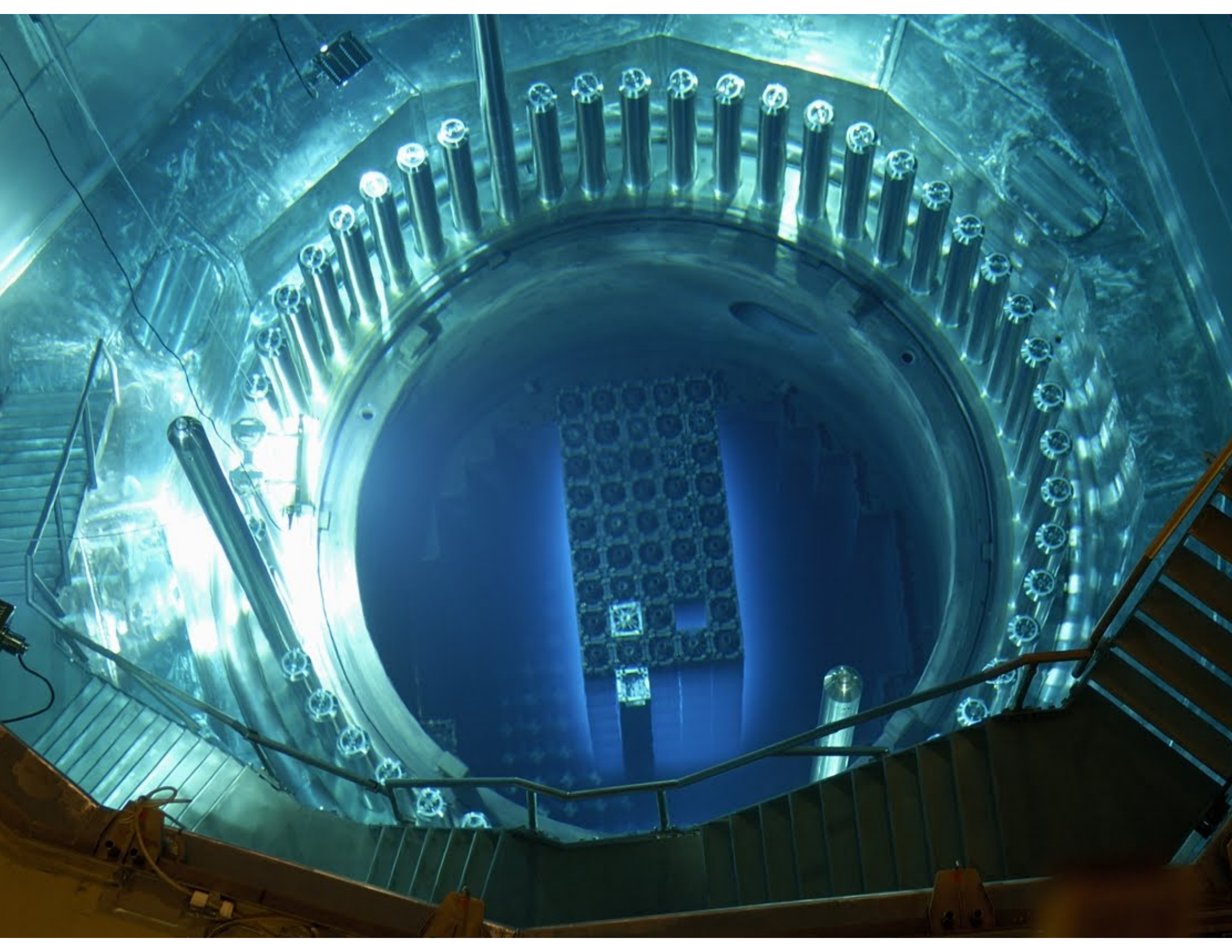


Lessons with a Pinch of AI: Hands-On Workshops for the Introduction of Machine Learning into Schools

Blaž Zupan

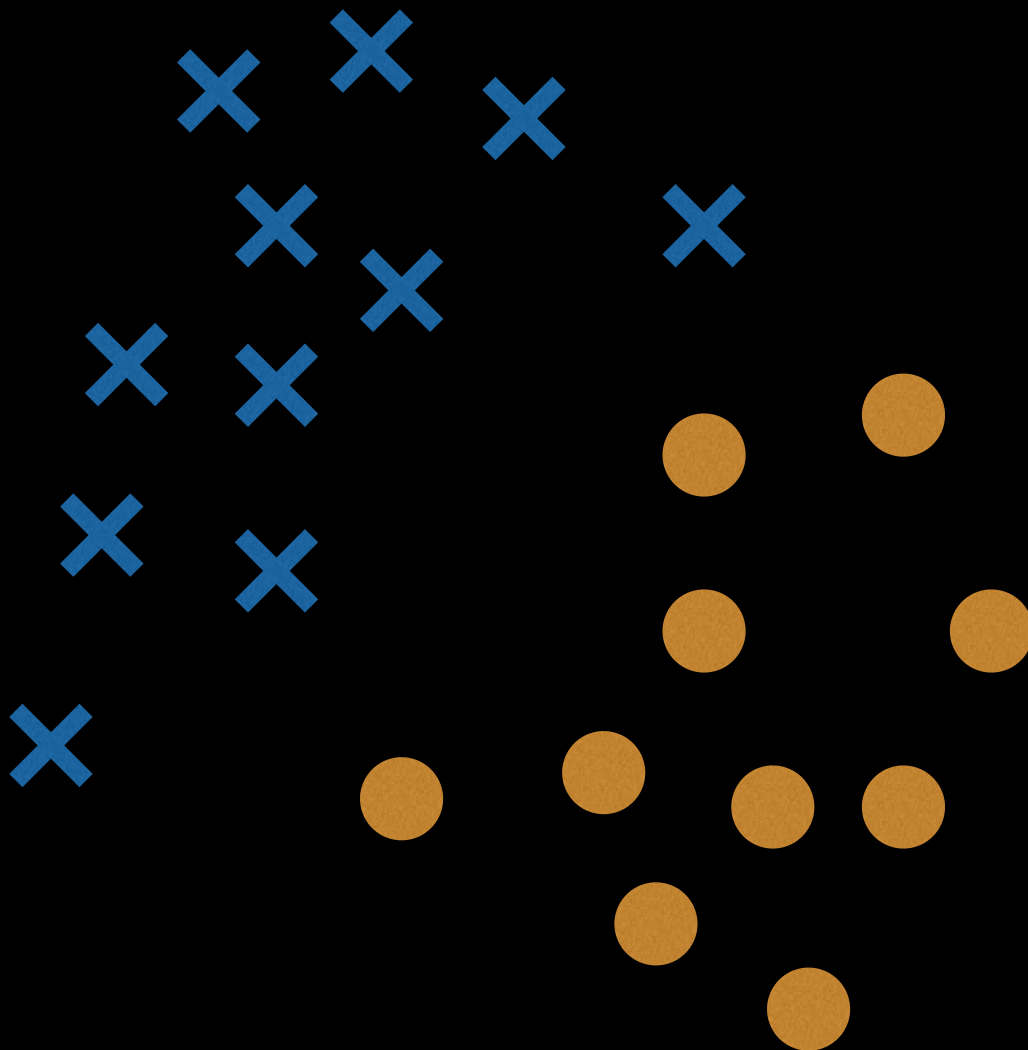
University of Ljubljana, Slovenia
Baylor College of Medicine, Houston, USA







```
- 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
```





```
def h(theta, x):  
    """Logistic function"""  
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        theta += alpha * (y - h(theta, x)).dot(x)  
    return theta
```

Assumptions

Artificial intelligence is the defining technology of the 21st 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 & Schools

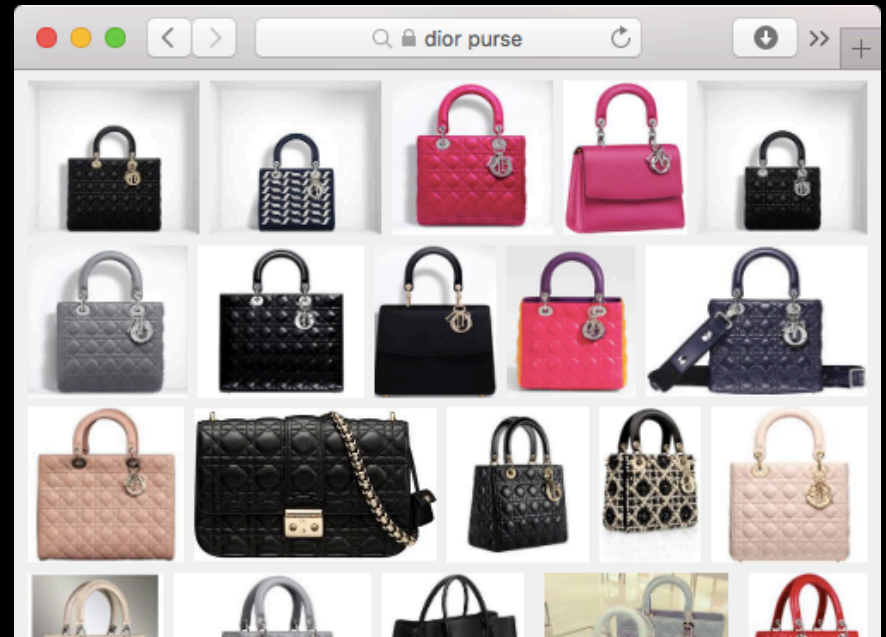
Can we train concepts of AI in schools? (not coding)

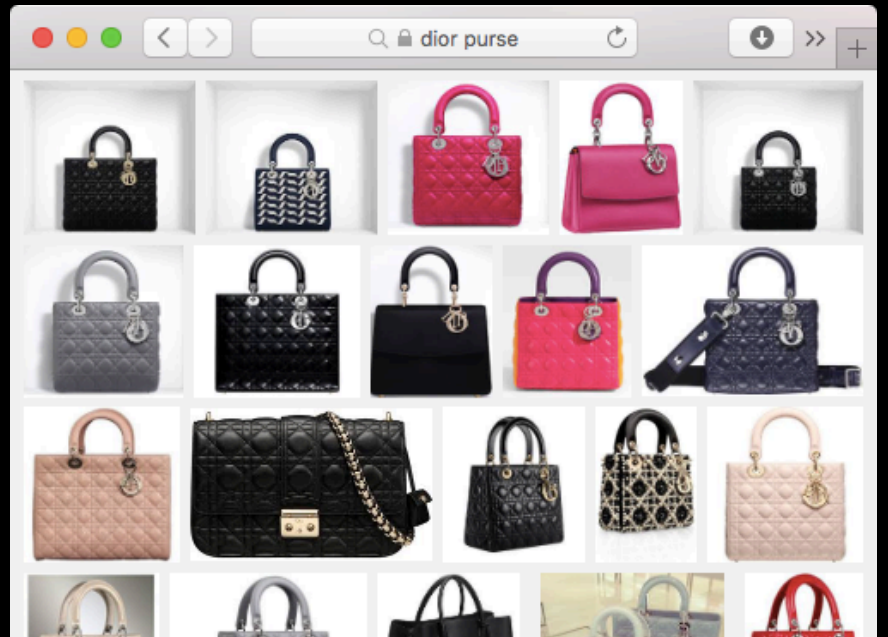
At which levels?

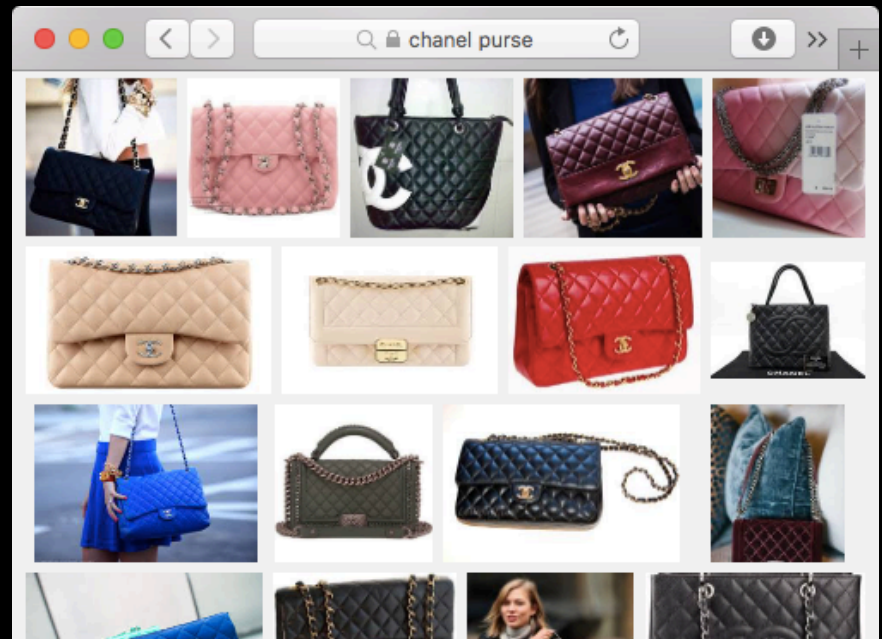
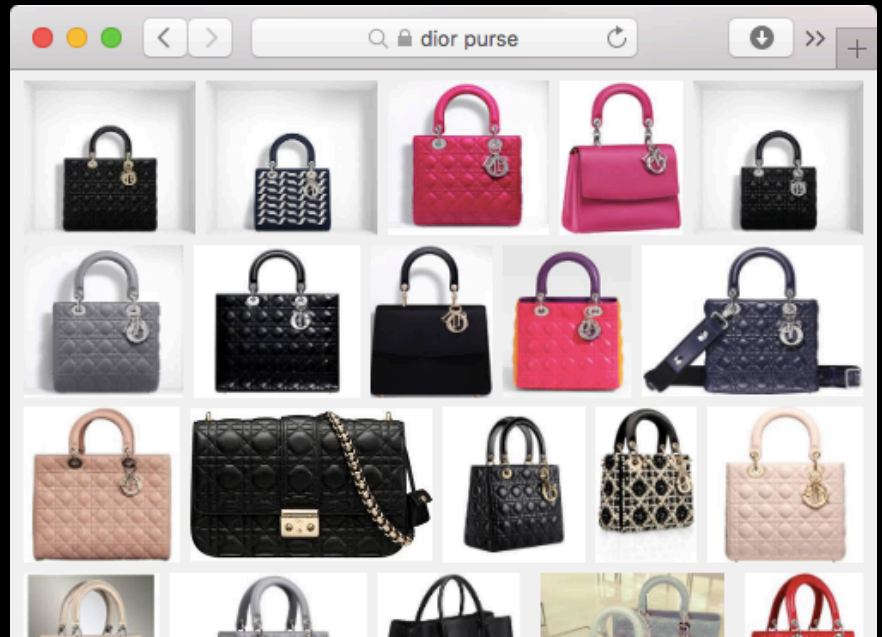
How?





















Purse Analytics: A Story









Name	Date Modified	Size	Kind
 chanel	14 Jun 2022 at 12:58	--	Folder
 c1.jpeg	30 Nov 2016 at 16:18	6 KB	JPEG image
 c2.jpeg	30 Nov 2016 at 16:18	7 KB	JPEG image
 c3.jpeg	30 Nov 2016 at 16:19	10 KB	JPEG image
 c4.jpeg	30 Nov 2016 at 16:19	8 KB	JPEG image
 c5.jpeg	30 Nov 2016 at 16:20	14 KB	JPEG image
 c6.jpeg	30 Nov 2016 at 16:20	6 KB	JPEG image
 c7.jpeg	1 Dec 2016 at 15:50	7 KB	JPEG image
 c8.jpeg	1 Dec 2016 at 15:52	9 KB	JPEG image
 c9.jpeg	1 Dec 2016 at 15:52	6 KB	JPEG image
 c10.jpeg	1 Dec 2016 at 15:52	6 KB	JPEG image
 dior	14 Jun 2022 at 12:58	--	Folder
 d1.jpeg	30 Nov 2016 at 16:08	7 KB	JPEG image
 d3.jpeg	30 Nov 2016 at 16:08	6 KB	JPEG image
 d4.jpeg	30 Nov 2016 at 16:08	8 KB	JPEG image
 d5.jpeg	30 Nov 2016 at 16:08	7 KB	JPEG image
 d6.jpeg	30 Nov 2016 at 16:09	7 KB	JPEG image
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 d8.jpeg	1 Dec 2016 at 15:46	9 KB	JPEG image
 d10.jpeg	1 Dec 2016 at 15:49	7 KB	JPEG image



Import Images

Import Images

purses ... Reload

Info

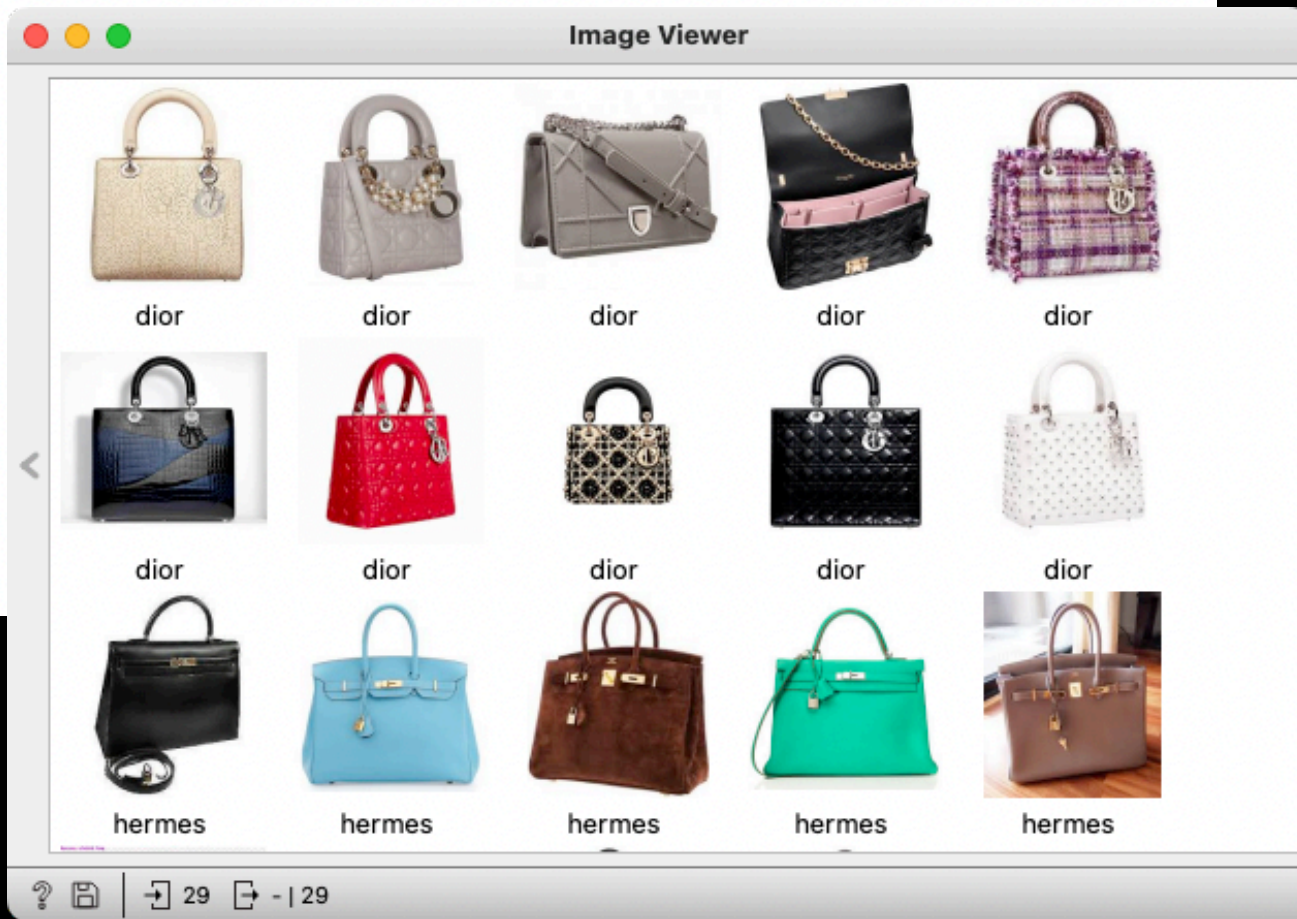
29 images / 3 categories

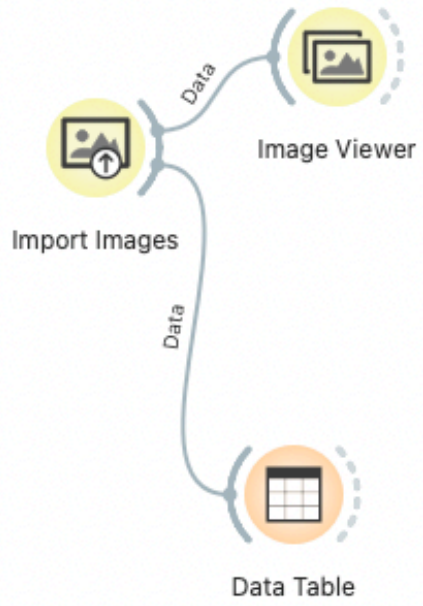
? | 29

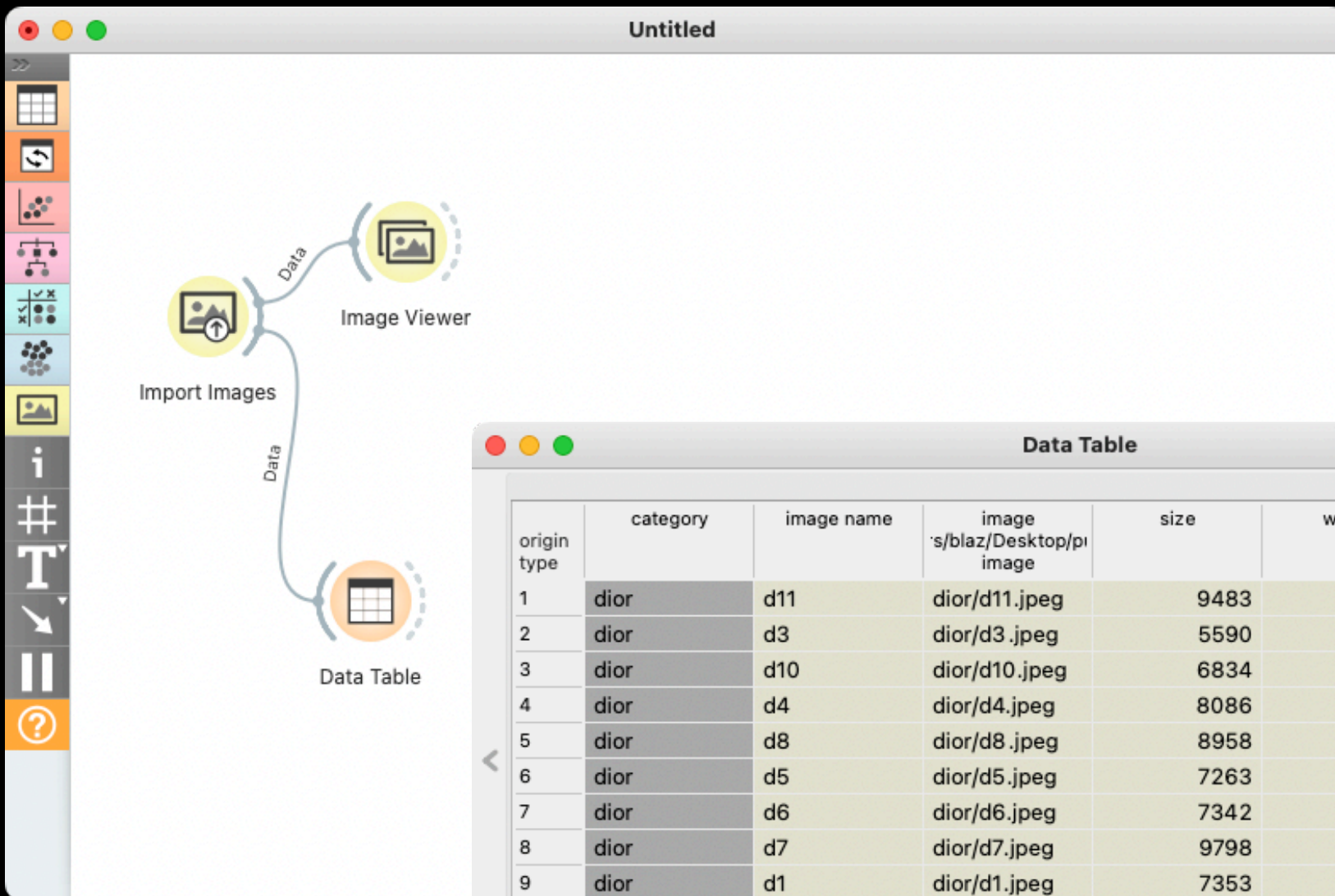




Import Images

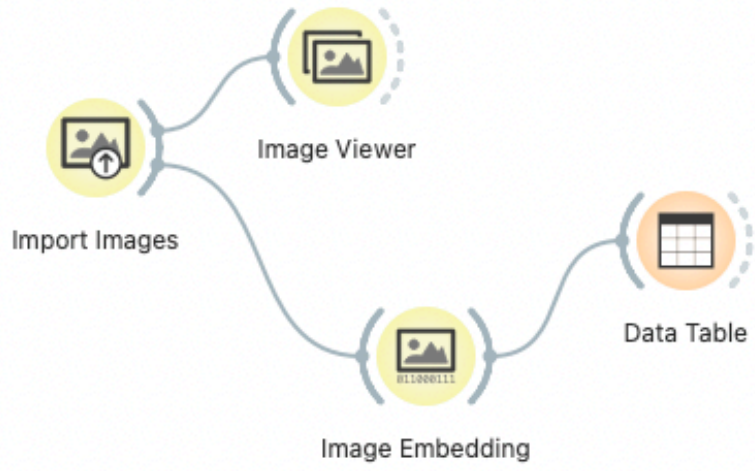
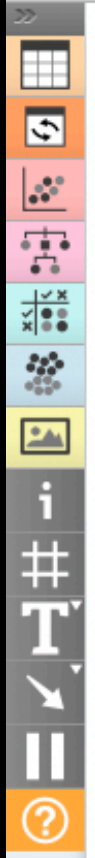


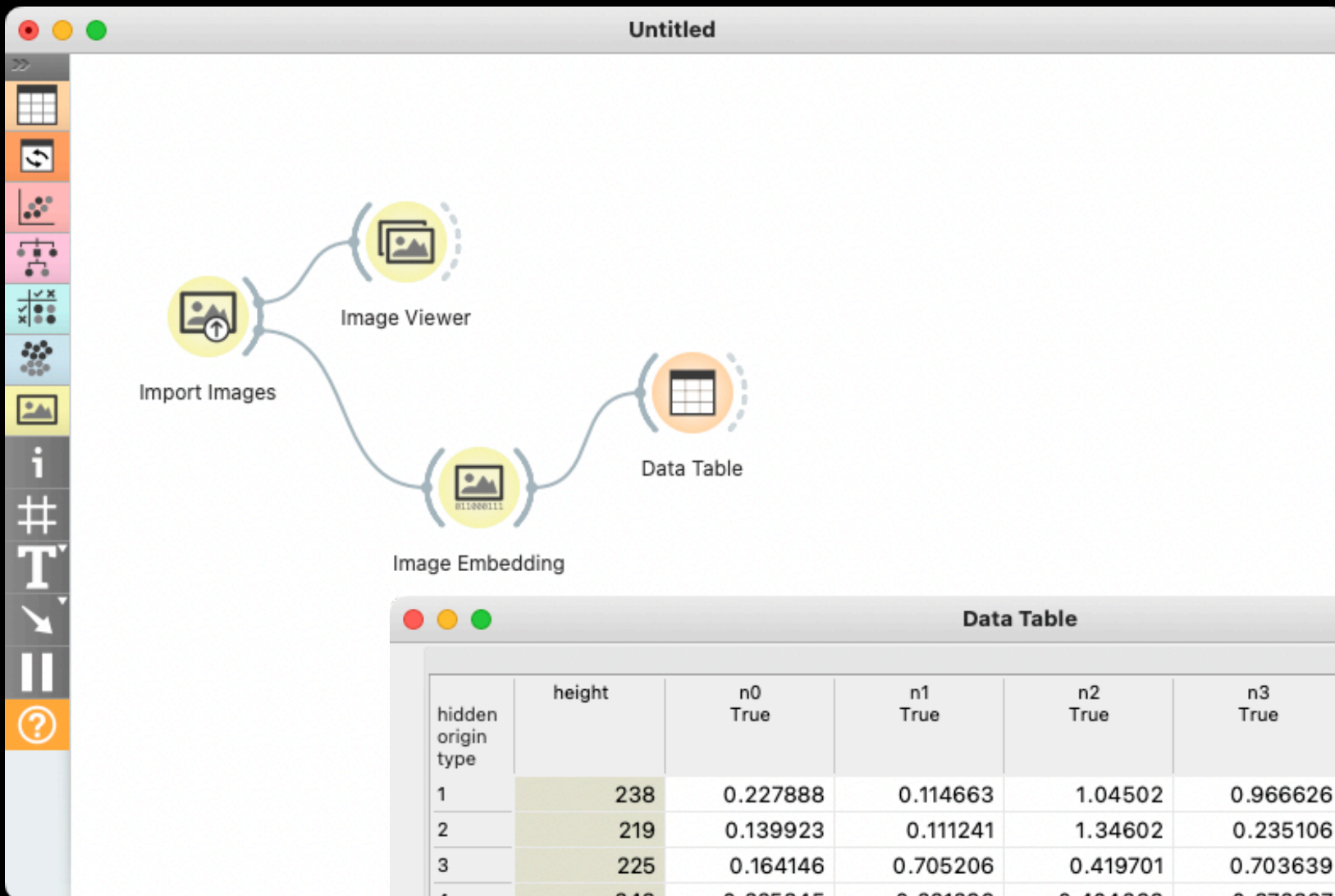




origin type	category	image name	image 's/blaz/Desktop/pi image	size	width	height
1	dior	d11	dior/d11.jpeg	9483	212	238
2	dior	d3	dior/d3.jpeg	5590	230	219
3	dior	d10	dior/d10.jpeg	6834	225	225
4	dior	d4	dior/d4.jpeg	8086	208	243
5	dior	d8	dior/d8.jpeg	8958	188	188
6	dior	d5	dior/d5.jpeg	7263	241	209
7	dior	d6	dior/d6.jpeg	7342	214	236
8	dior	d7	dior/d7.jpeg	9798	284	177
9	dior	d1	dior/d1.jpeg	7353	238	212
10	dior	d12	dior/d12.jpeg	5486	222	227
11	hermes	g	hermes/g.jpeg	5488	225	225
12	hermes	f	hermes/f.jpeg	4472	232	217
13	hermes	i	hermes/i.jpeg	5146	188	212

29 | 29

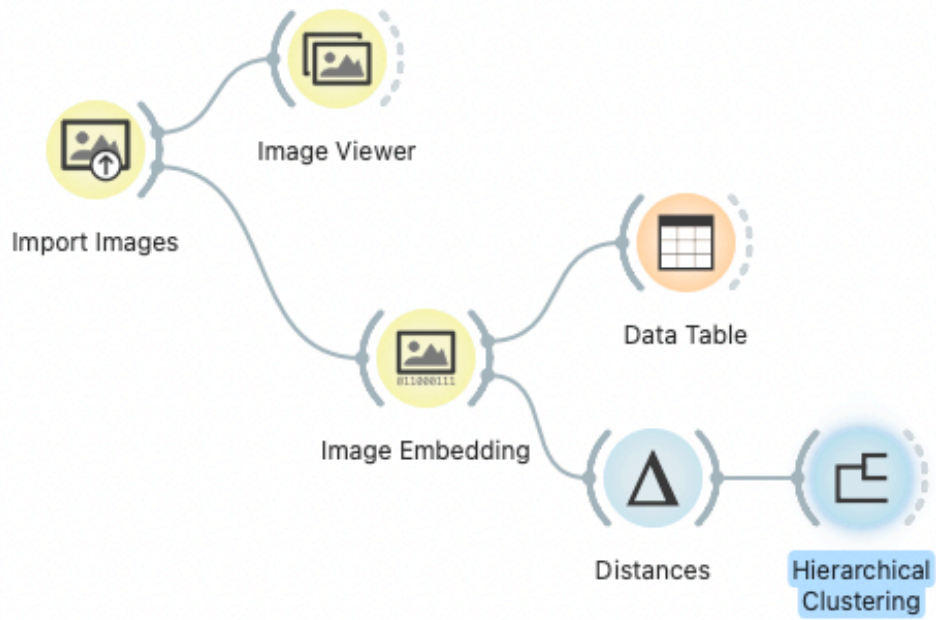
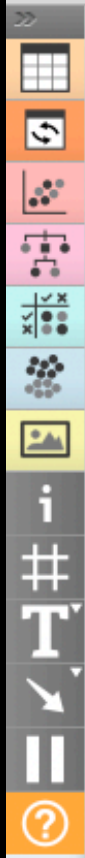


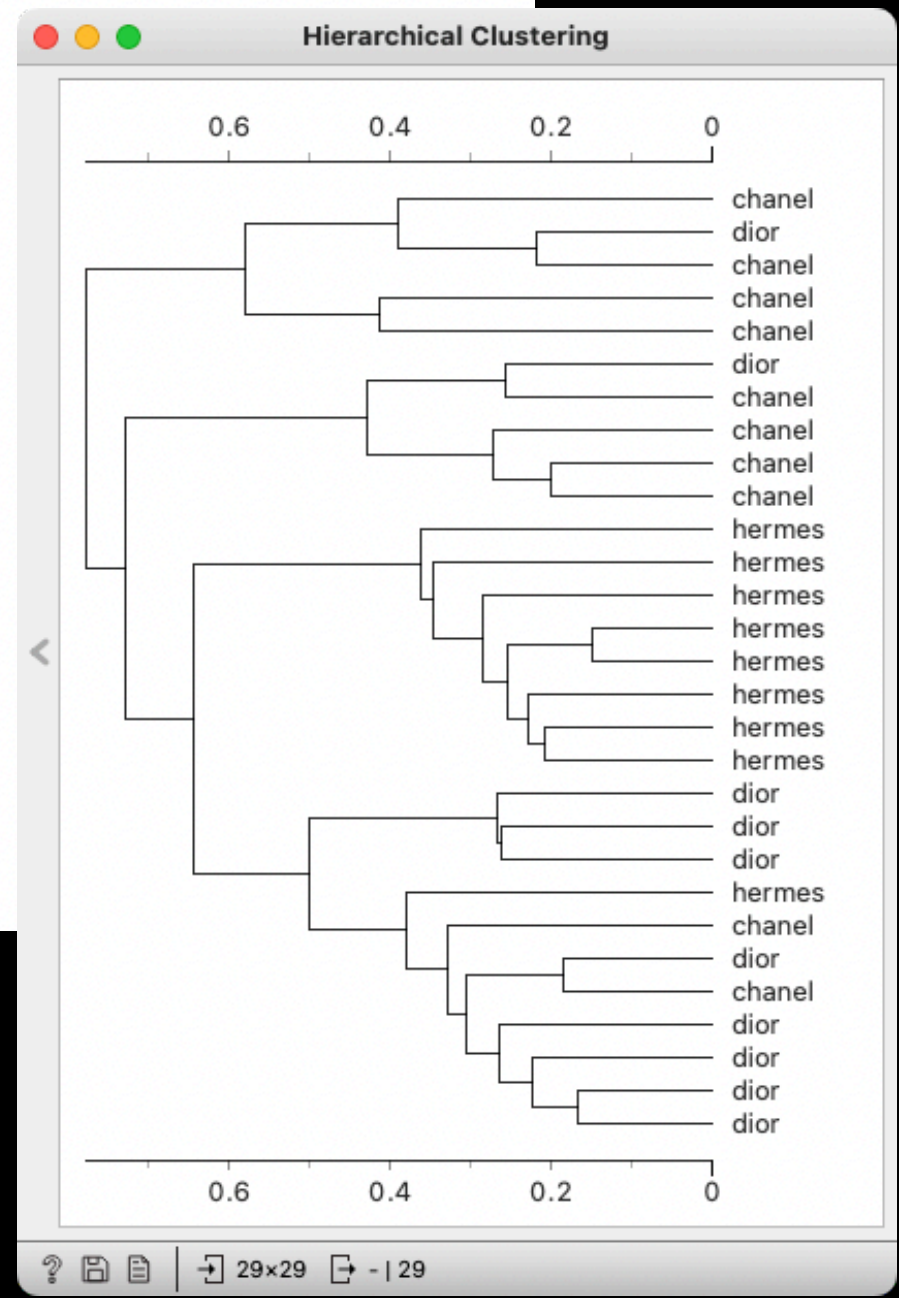
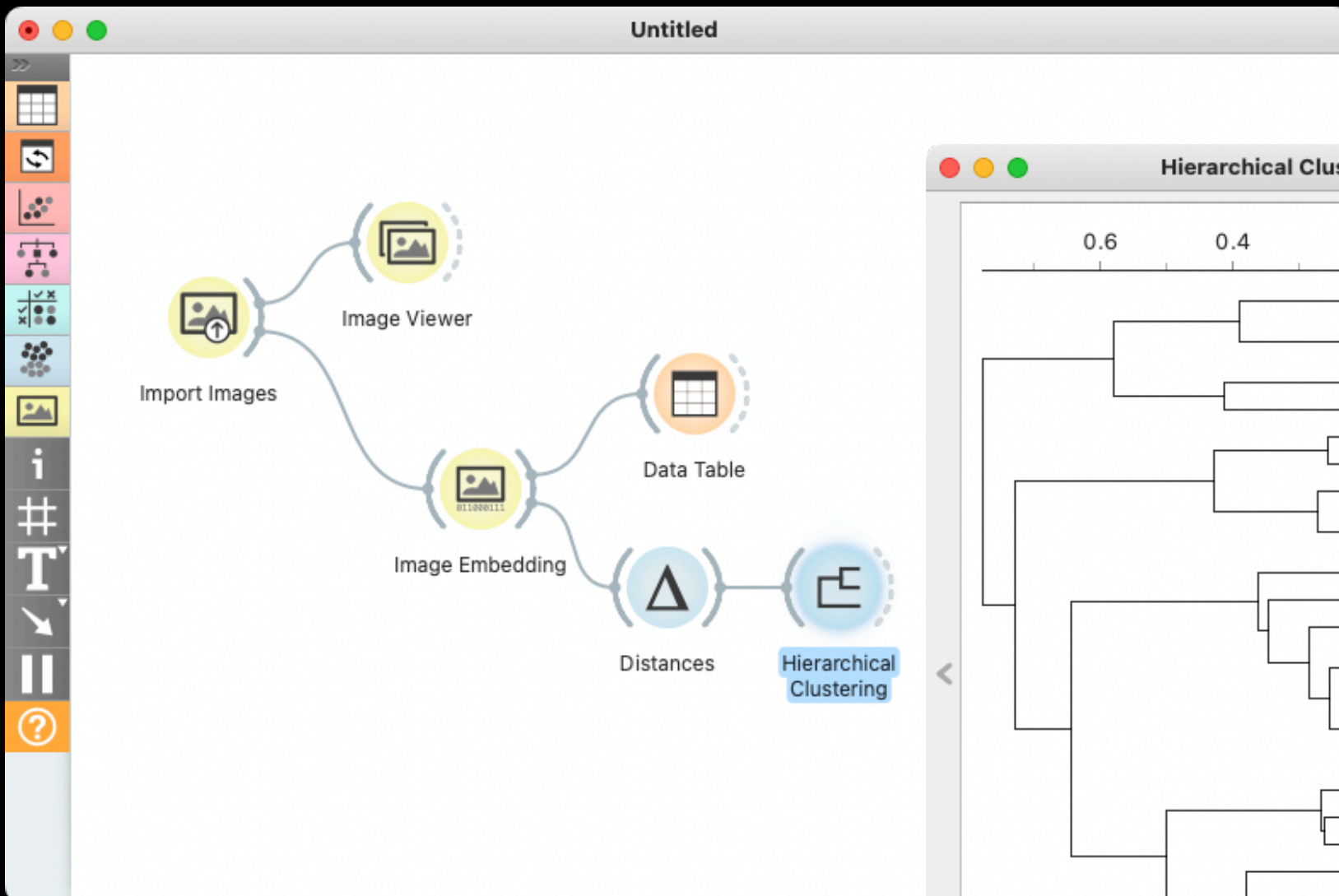


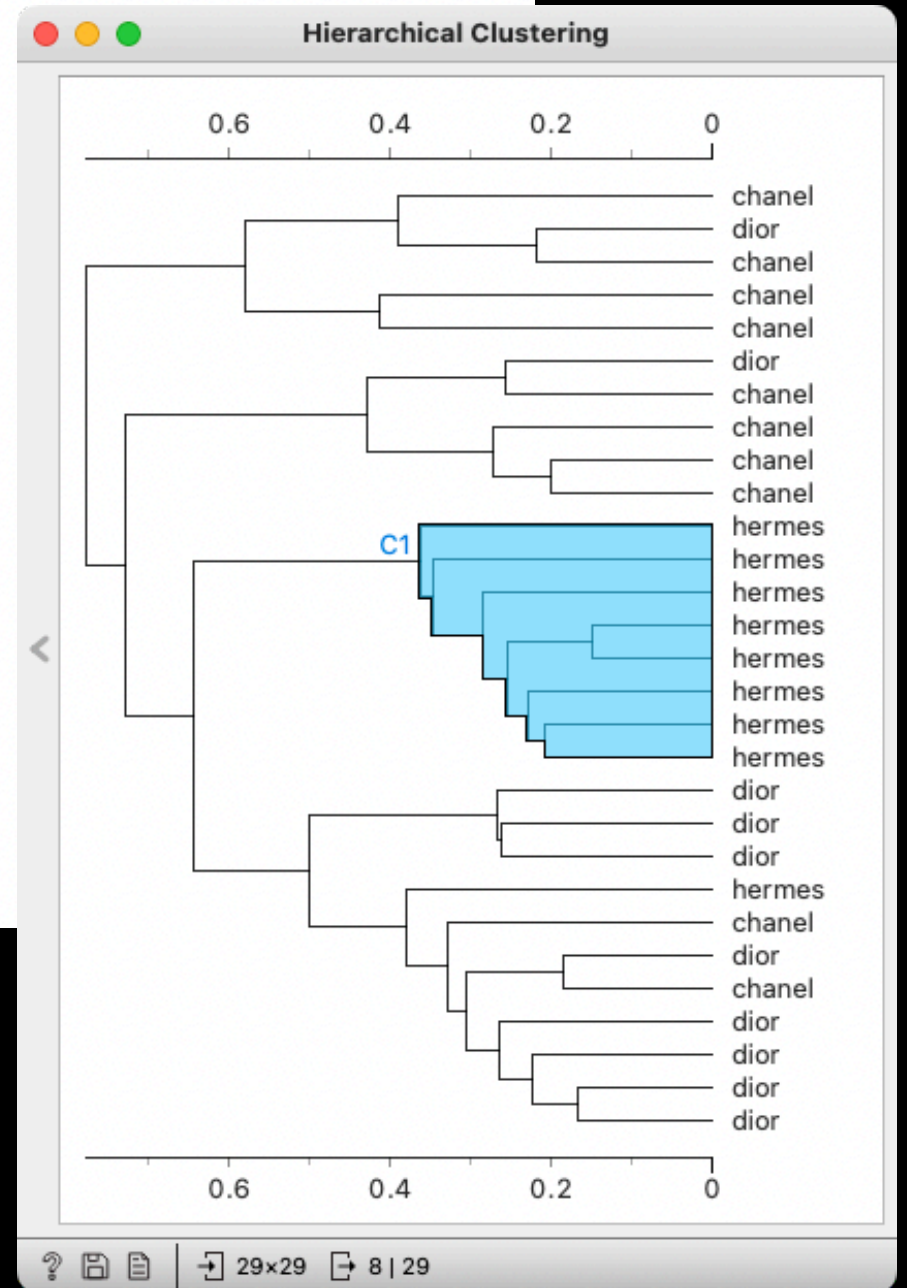
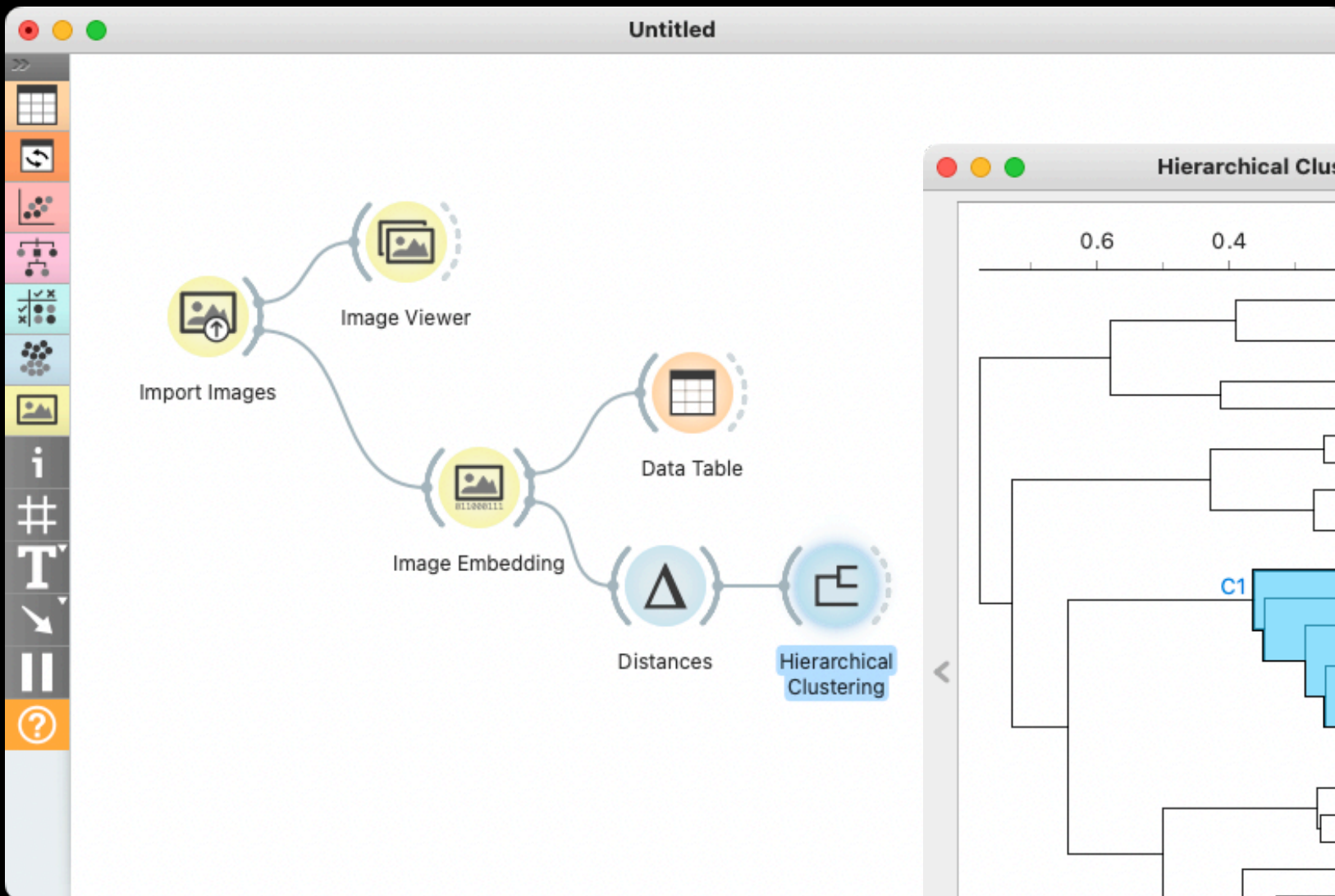
Data Table

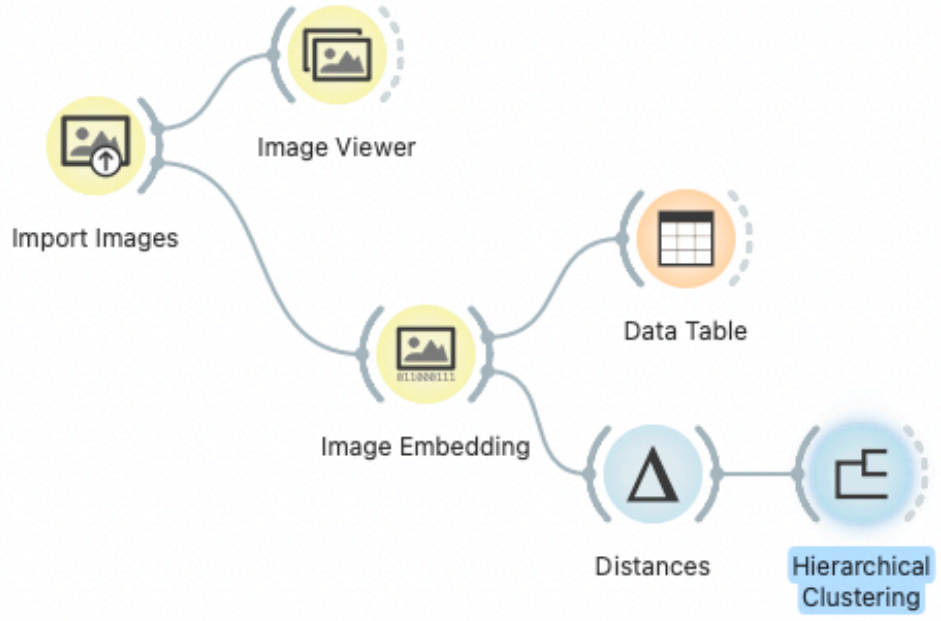
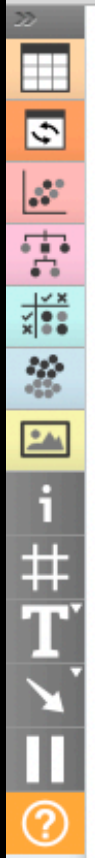
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1	238	0.227888	0.114663	1.04502	0.966626	0.23655	0.0312
2	219	0.139923	0.111241	1.34602	0.235106	0.424284	0.0112
3	225	0.164146	0.705206	0.419701	0.703639	0.670237	0.0327
4	243	0.225345	0.221296	0.404263	0.372397	0.104614	0.0802
5	188	0.630233	0.101799	0.533562	0.175556	0.0272911	0.0135
6	209	0.450743	0.202172	0.318949	0.505032	0.155198	0.138
7	236	0.465259	0.158482	0.222262	0.494528	0.374608	0.0541
8	177	0.0215298	0.205826	0.341256	0.150828	0.276771	0.0424
9	212	0.249248	0.195387	0.245239	0.0952234	0.208555	0.0245
10	227	0.206475	0.168053	0.82562	0.274429	0.264415	0.114
11	225	0.103662	0.0833464	0.228245	0.409944	0.206696	0.111
12	217	0.0555655	0.436552	0.0286173	0.454649	0.274221	0.0160

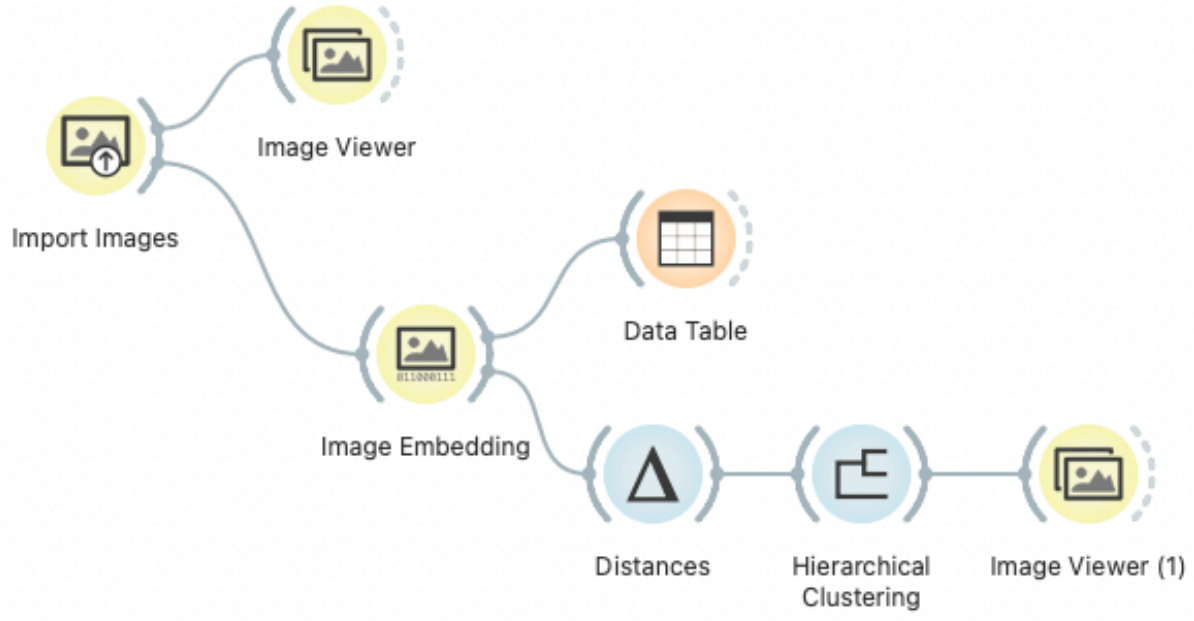
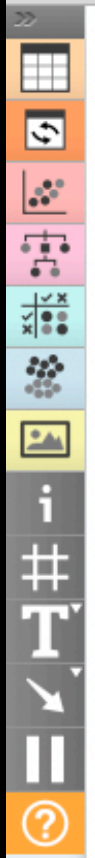
Navigation: ? | 29 | 29 | 29

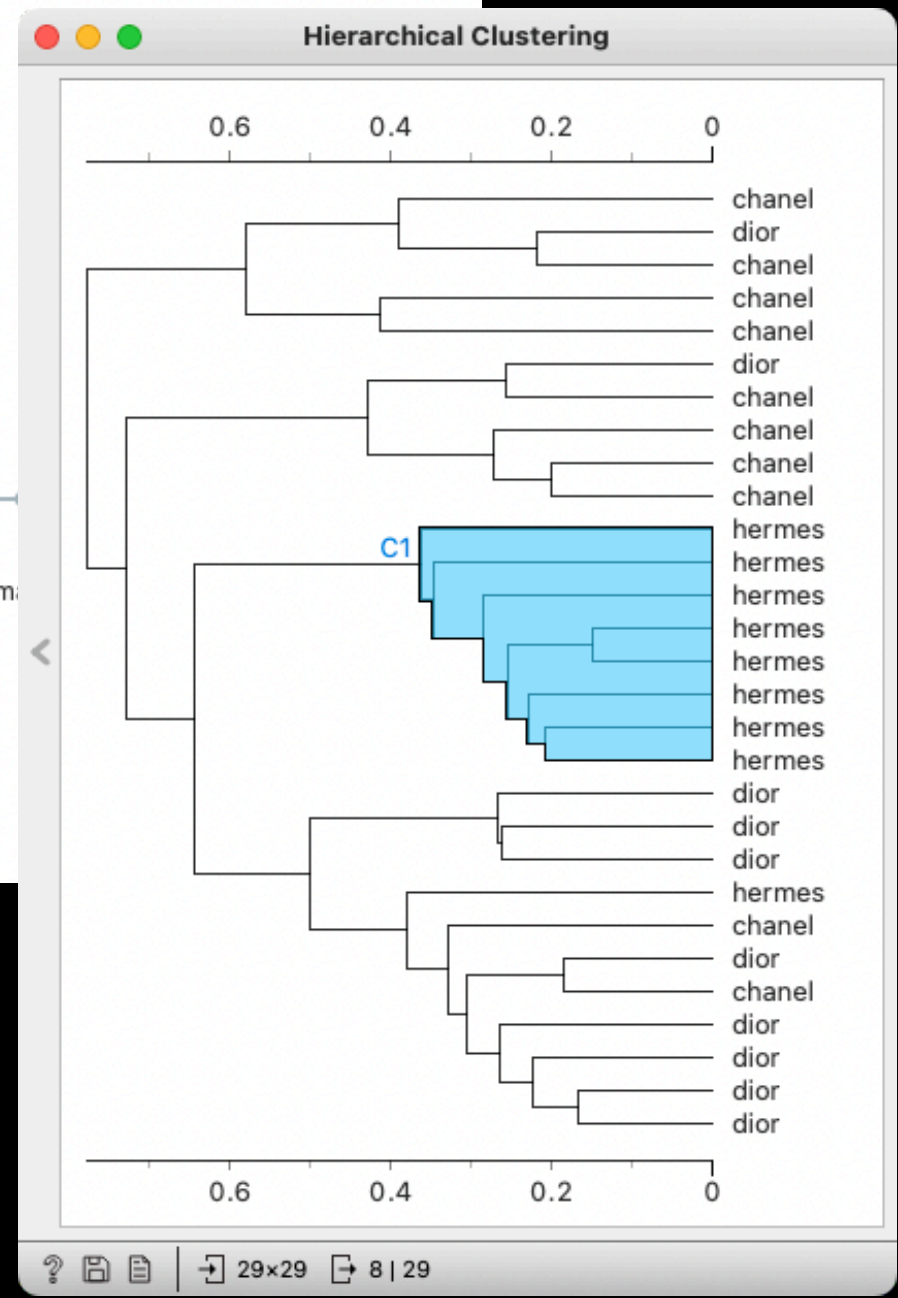
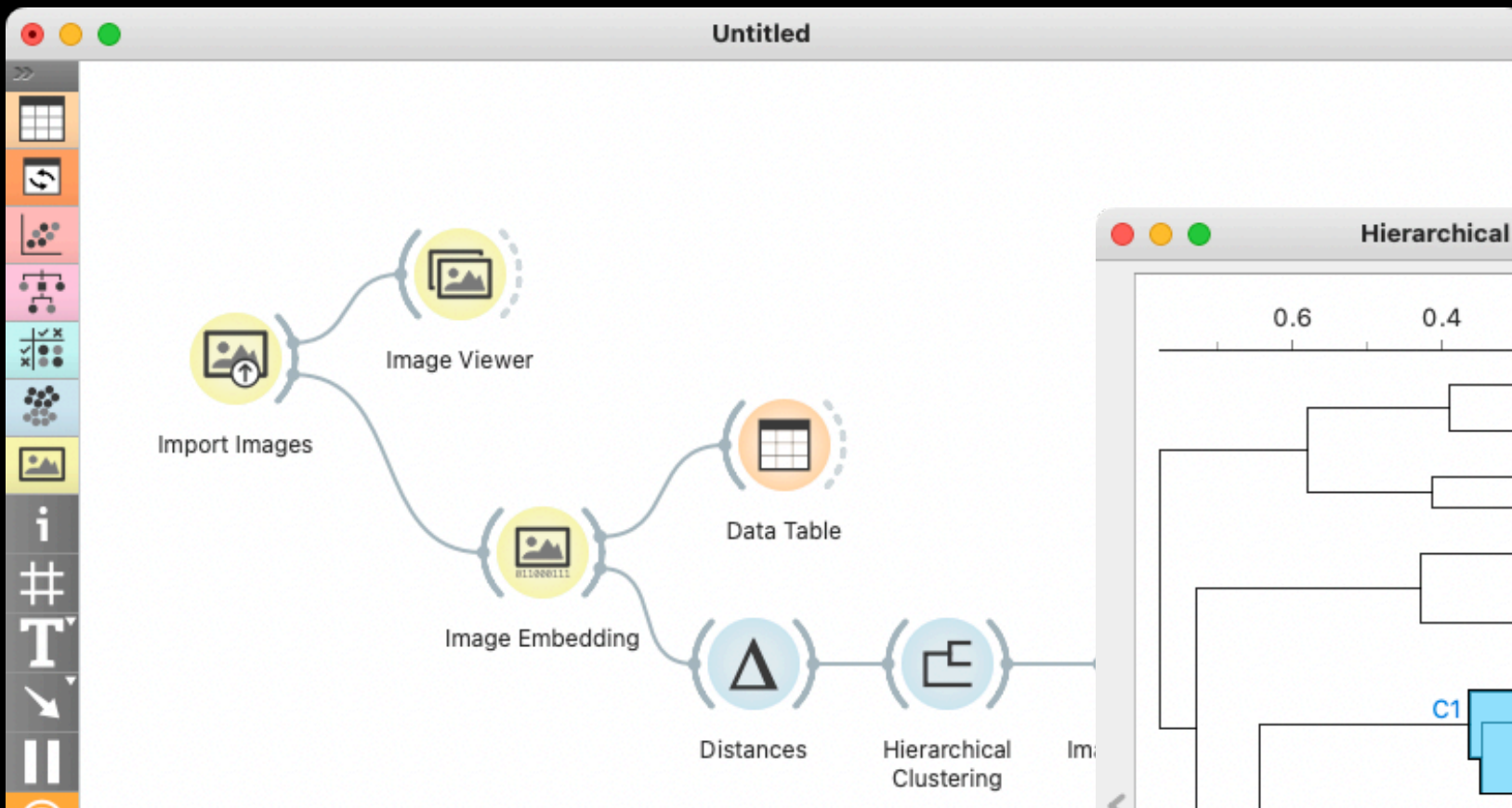


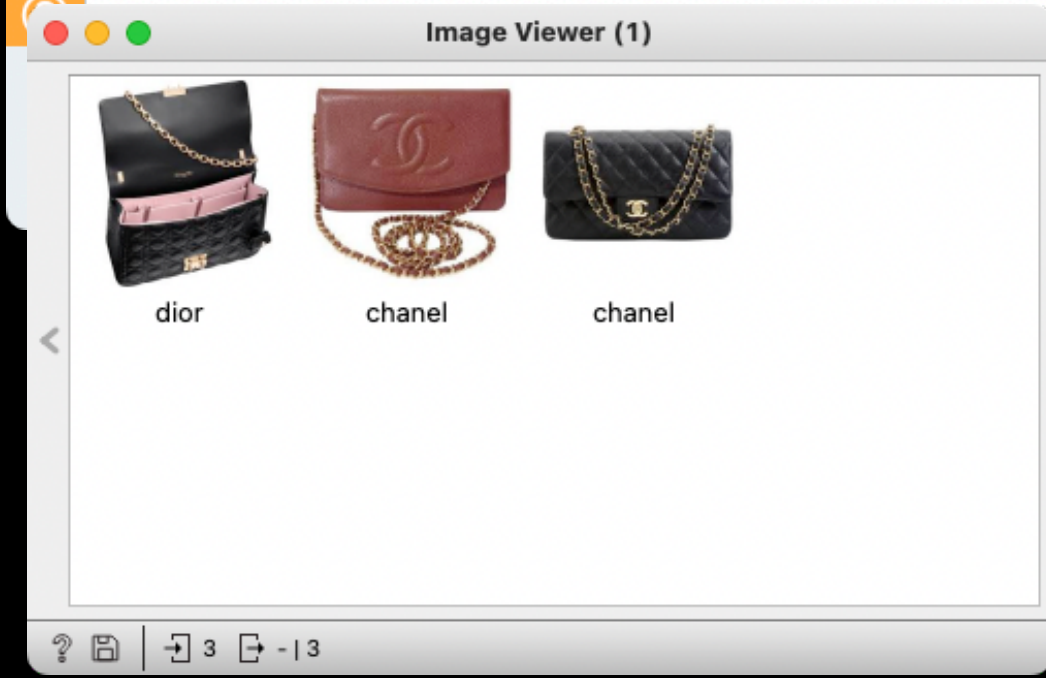
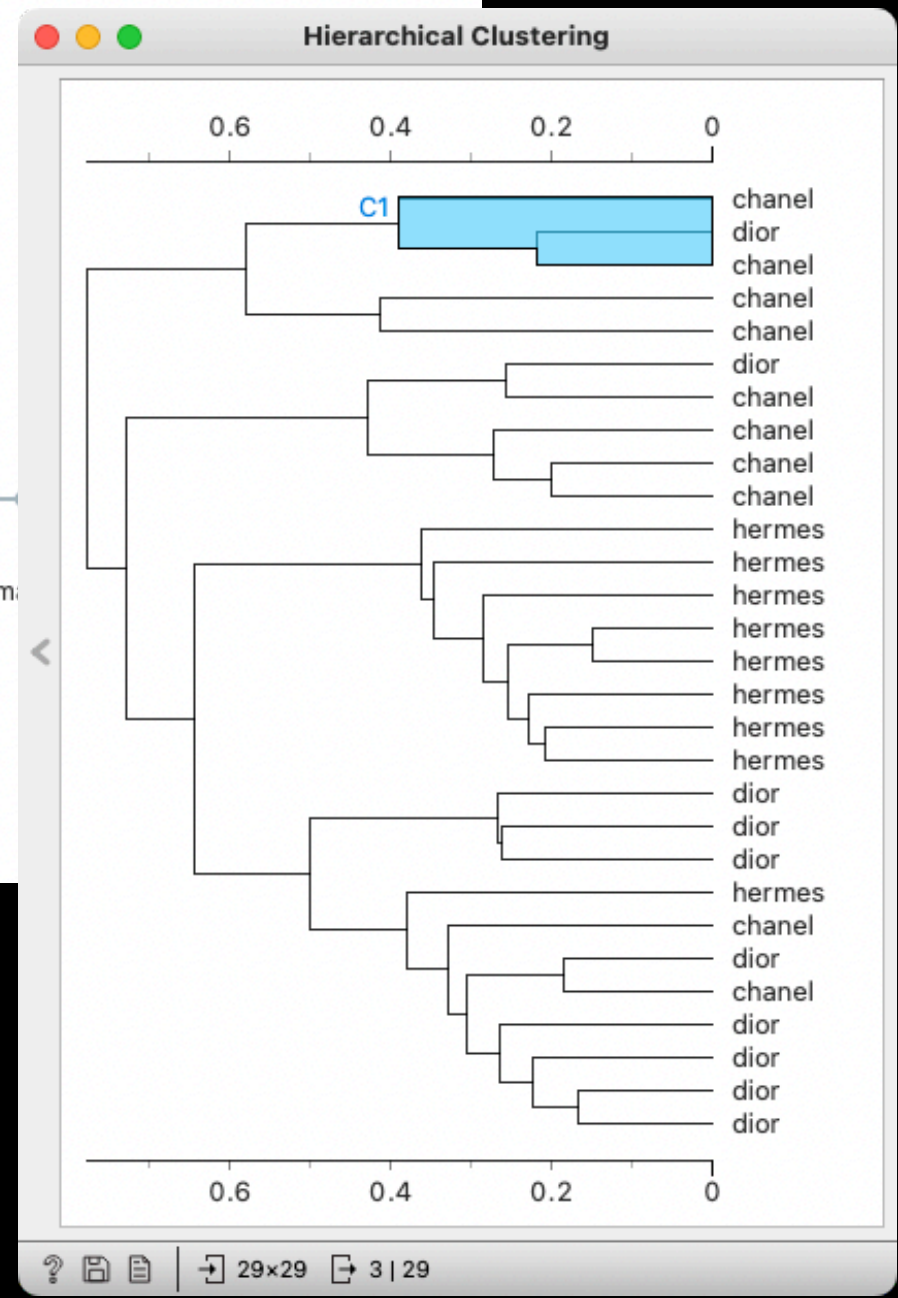
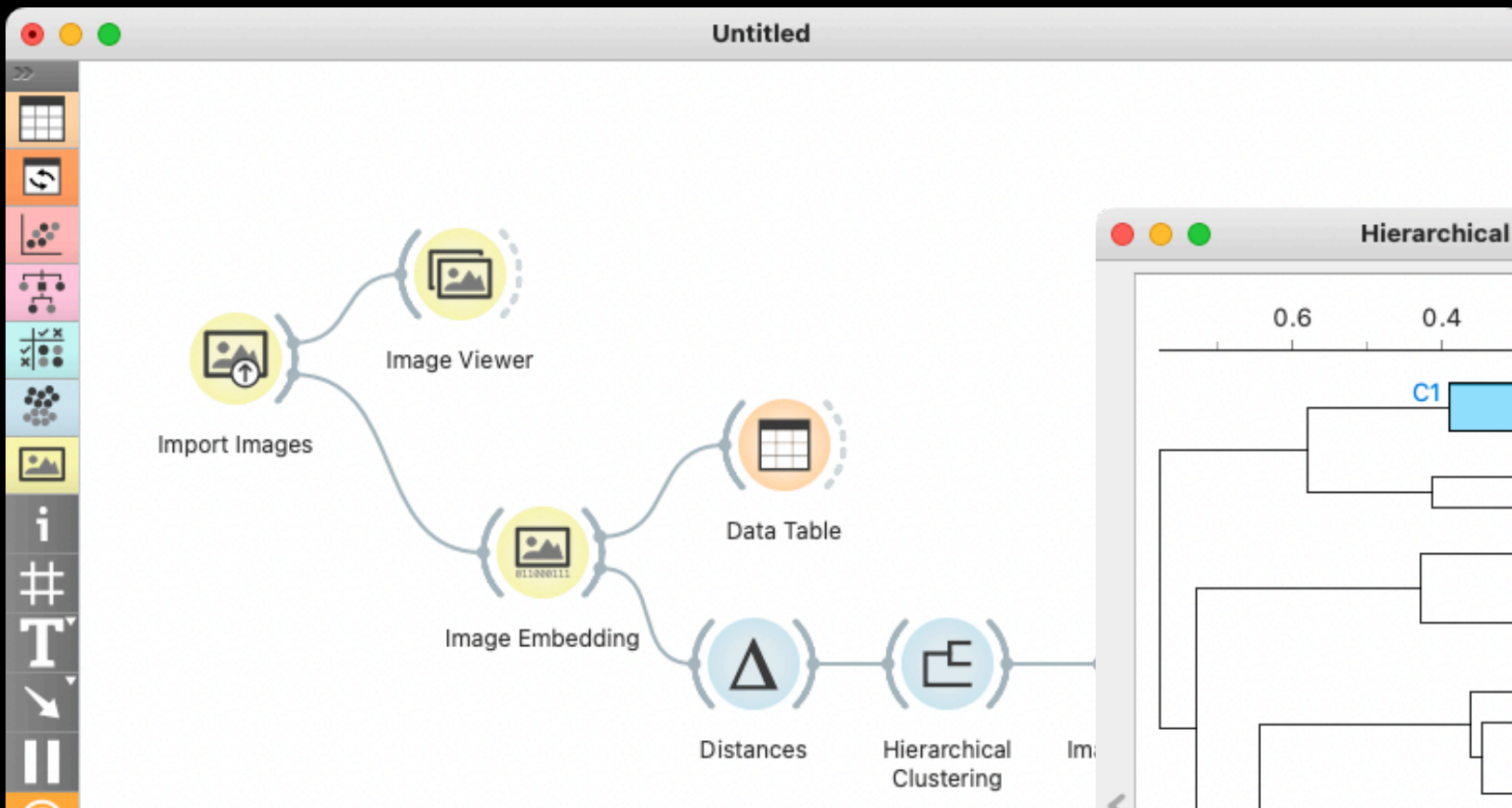


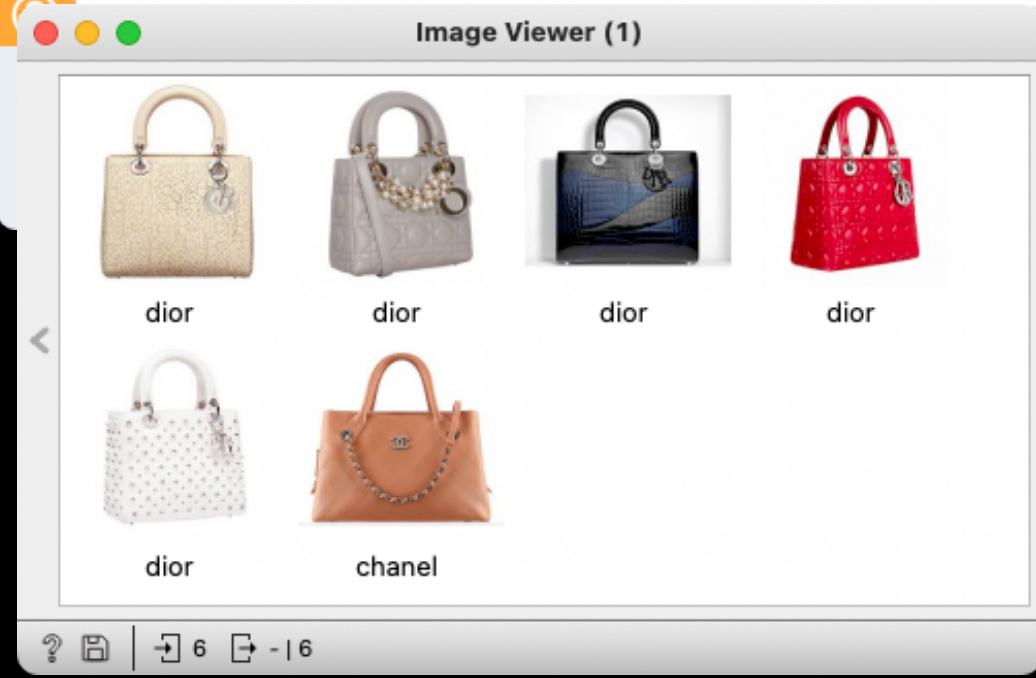
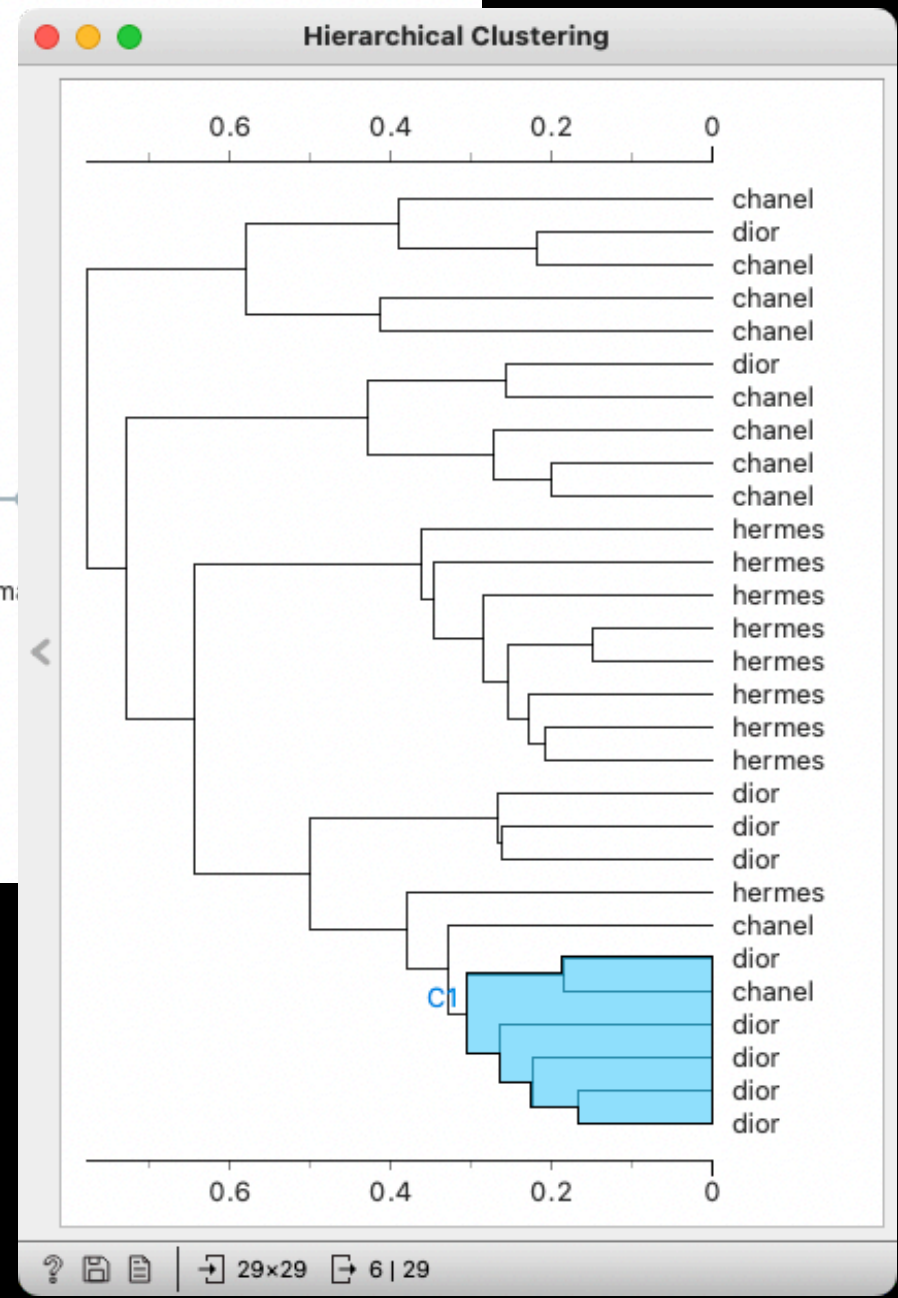
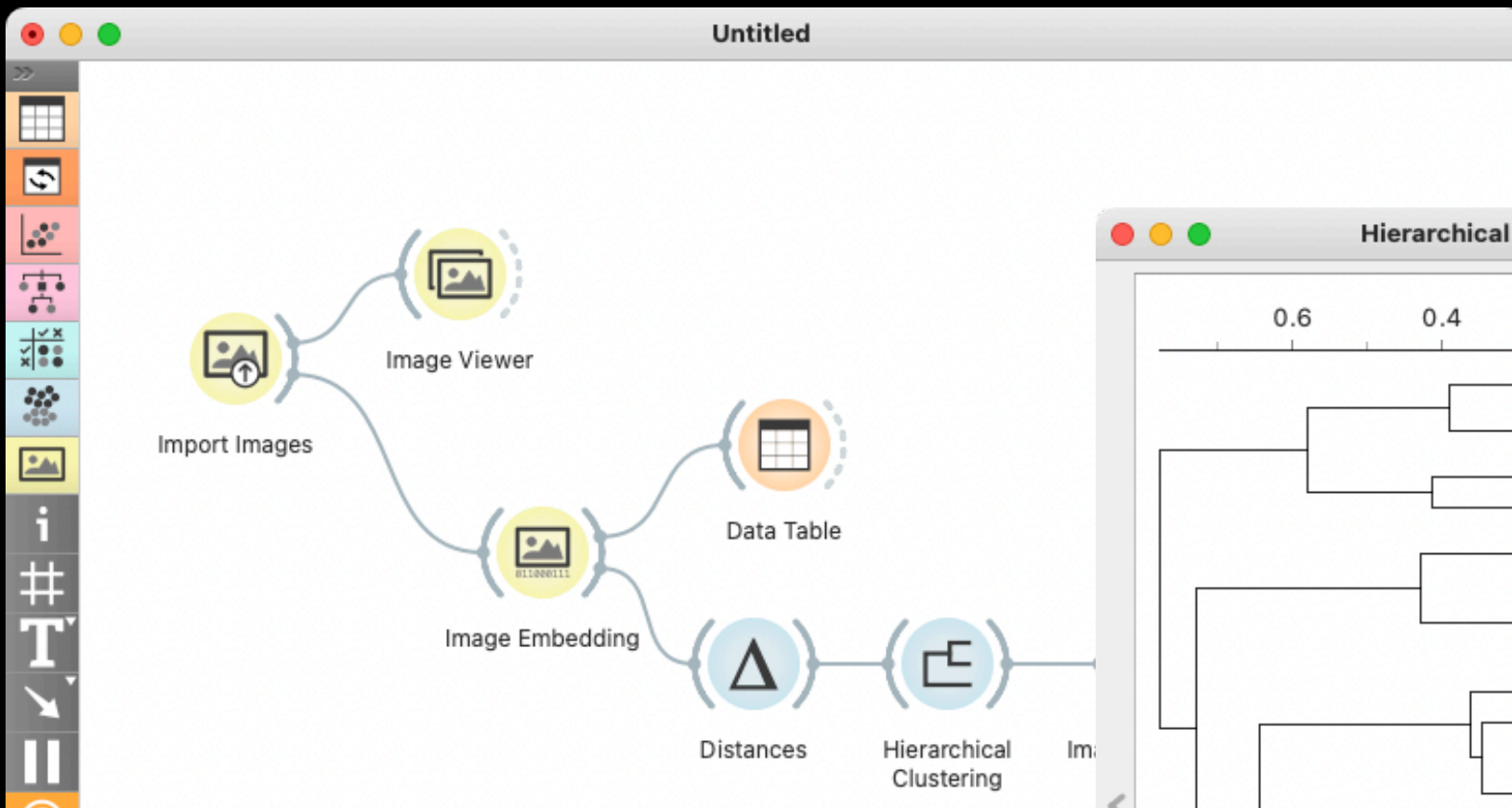


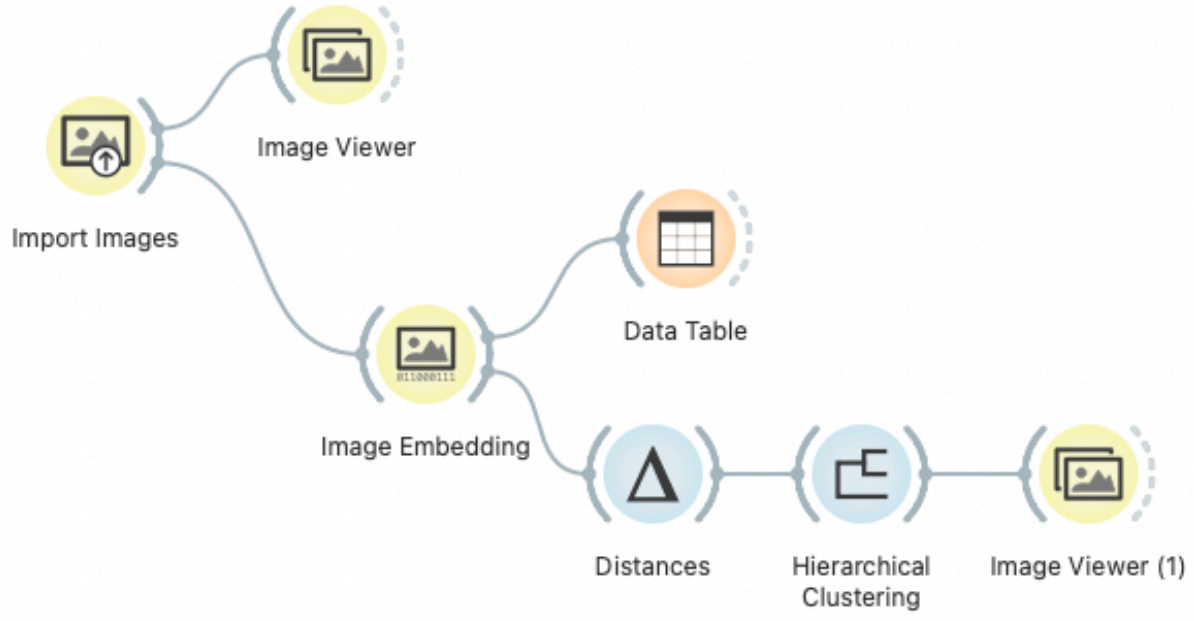
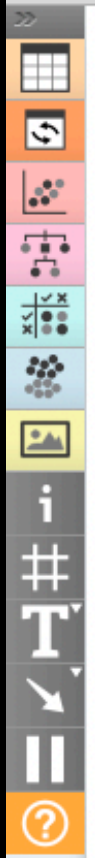


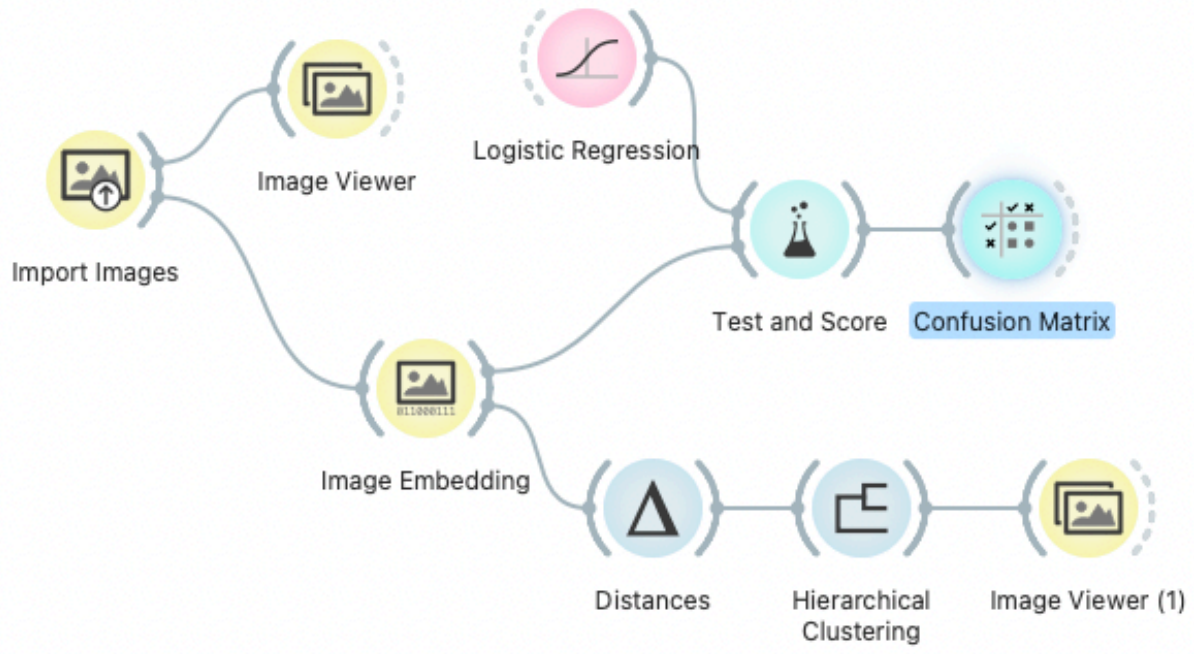


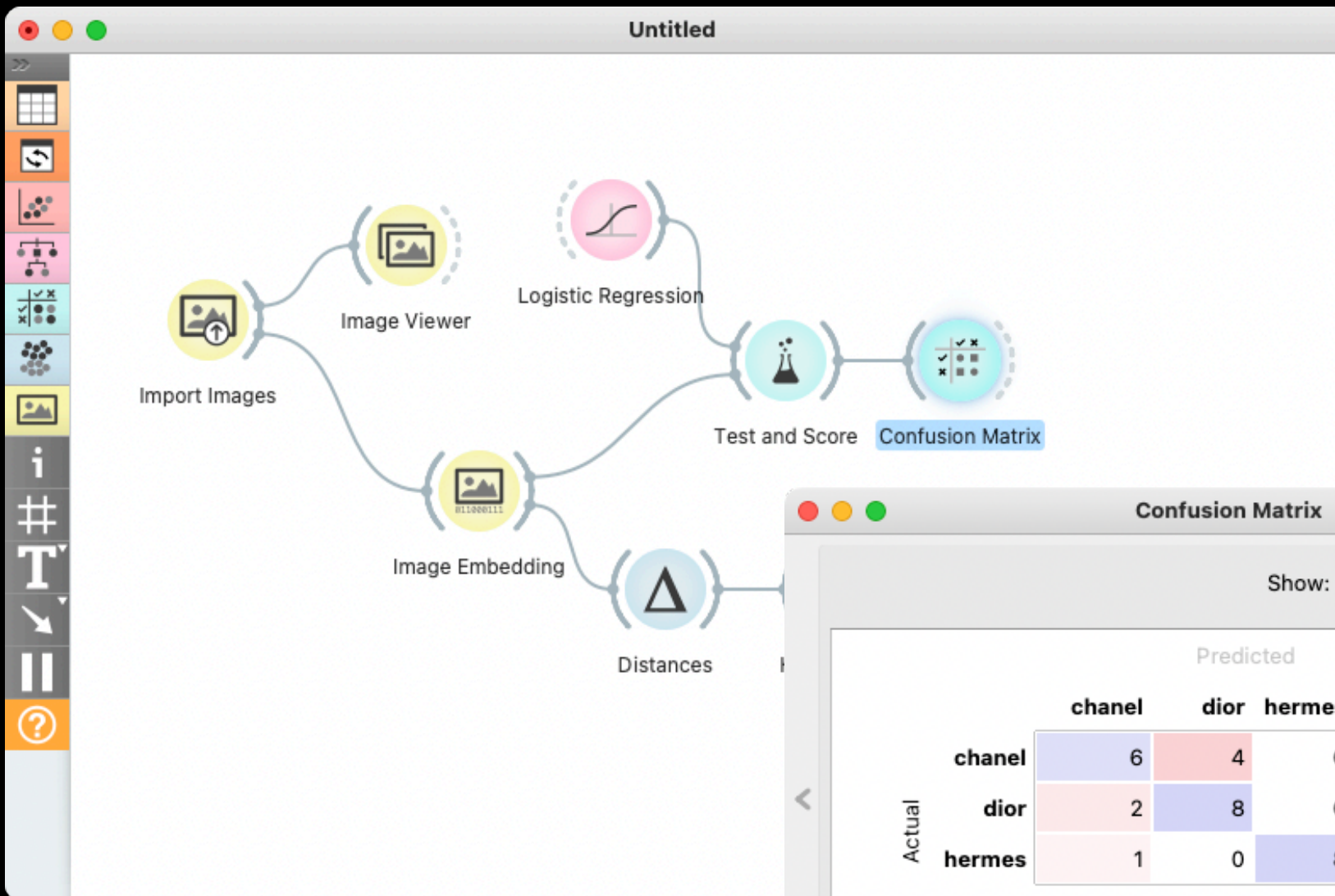










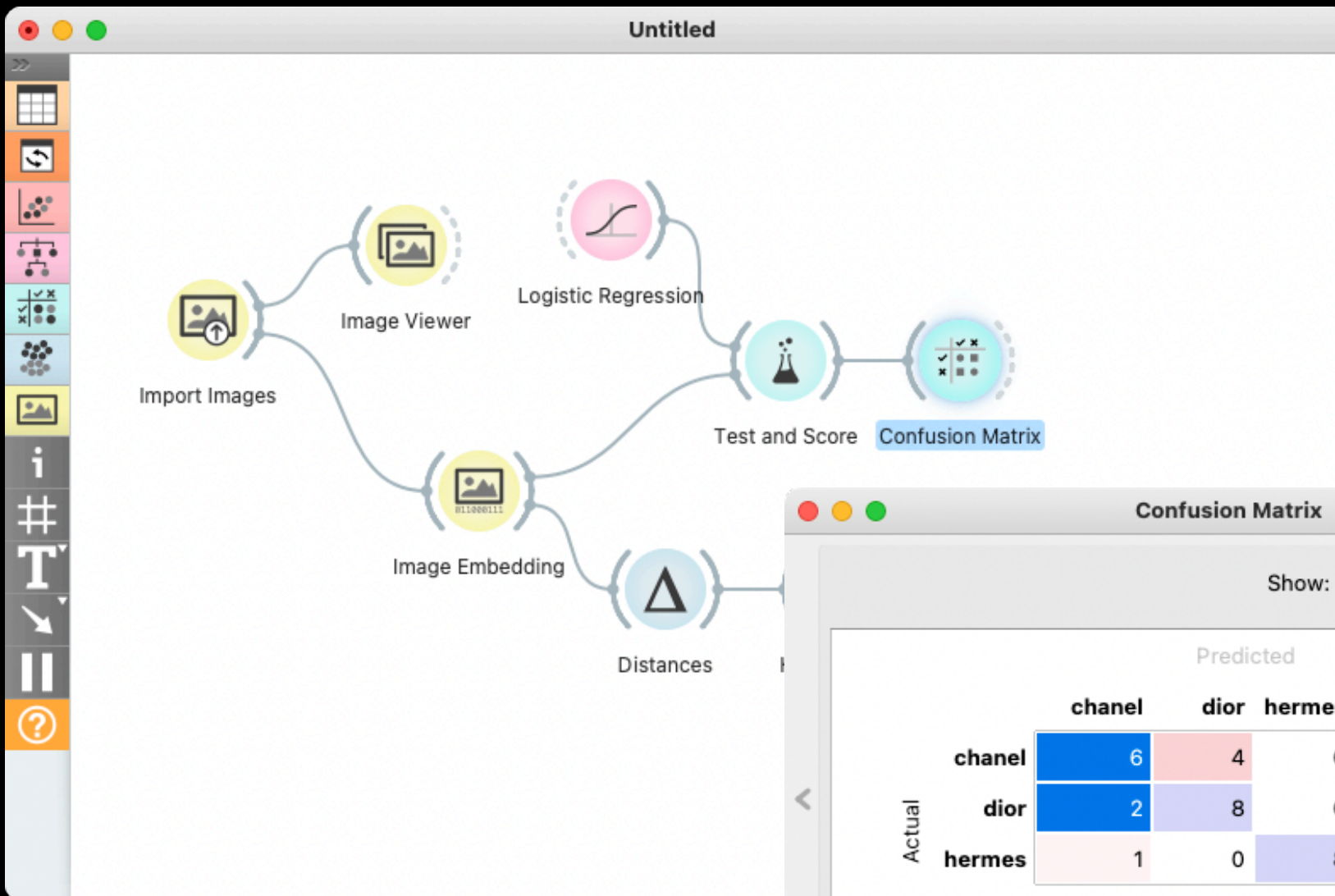


Confusion Matrix

Show:

		Predicted			Σ
		chanel	dior	hermes	
Actual	chanel	6	4	0	10
	dior	2	8	0	10
	hermes	1	0	8	9
Σ		9	12	8	29

? | 1x29 | - | 29



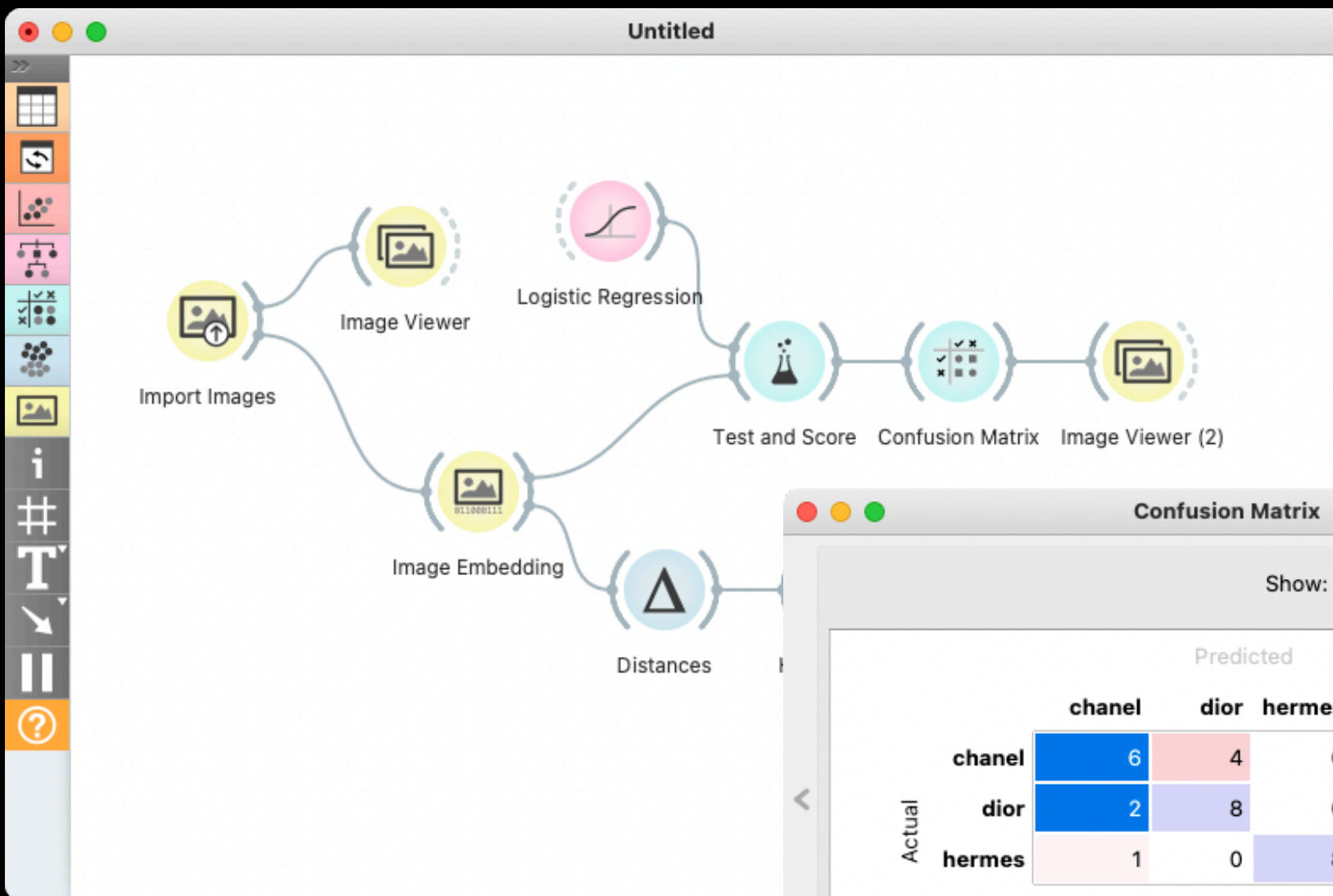
Confusion Matrix

Show:

		Predicted			Σ
		chanel	dior	hermes	
Actual	chanel	6	4	0	10
	dior	2	8	0	10
	hermes	1	0	8	9
Σ		9	12	8	29

Select Correct Select Misclassified Clear Selection

? | 1x29 | 8 | 29



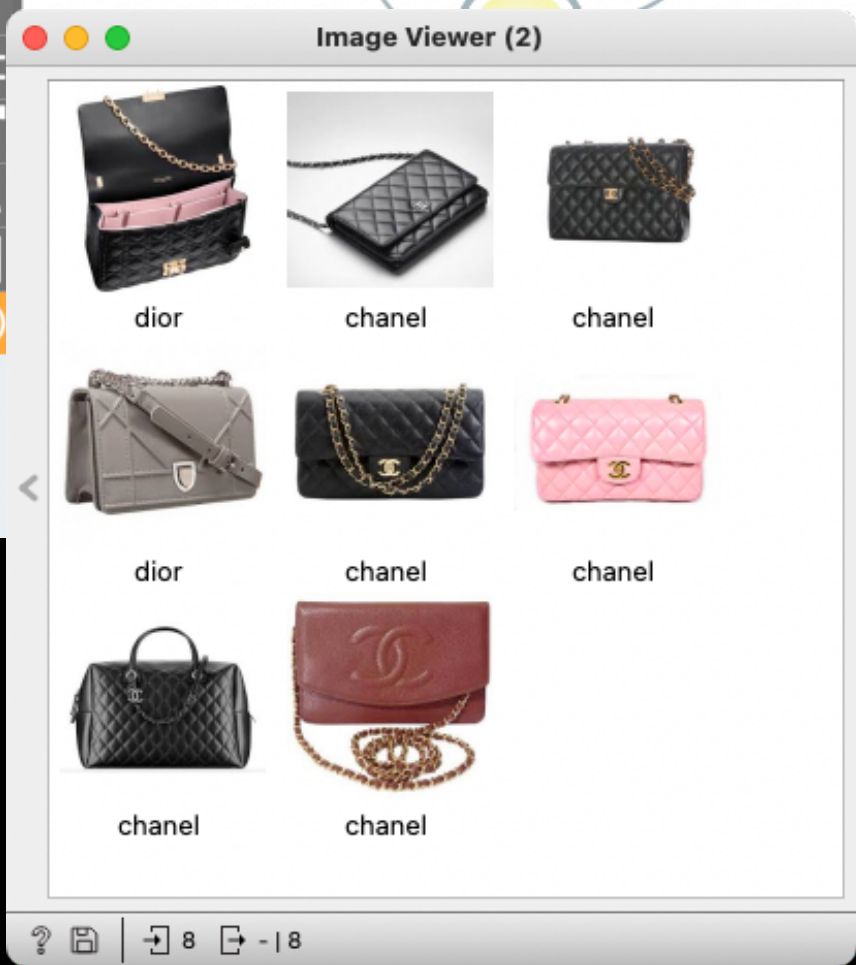
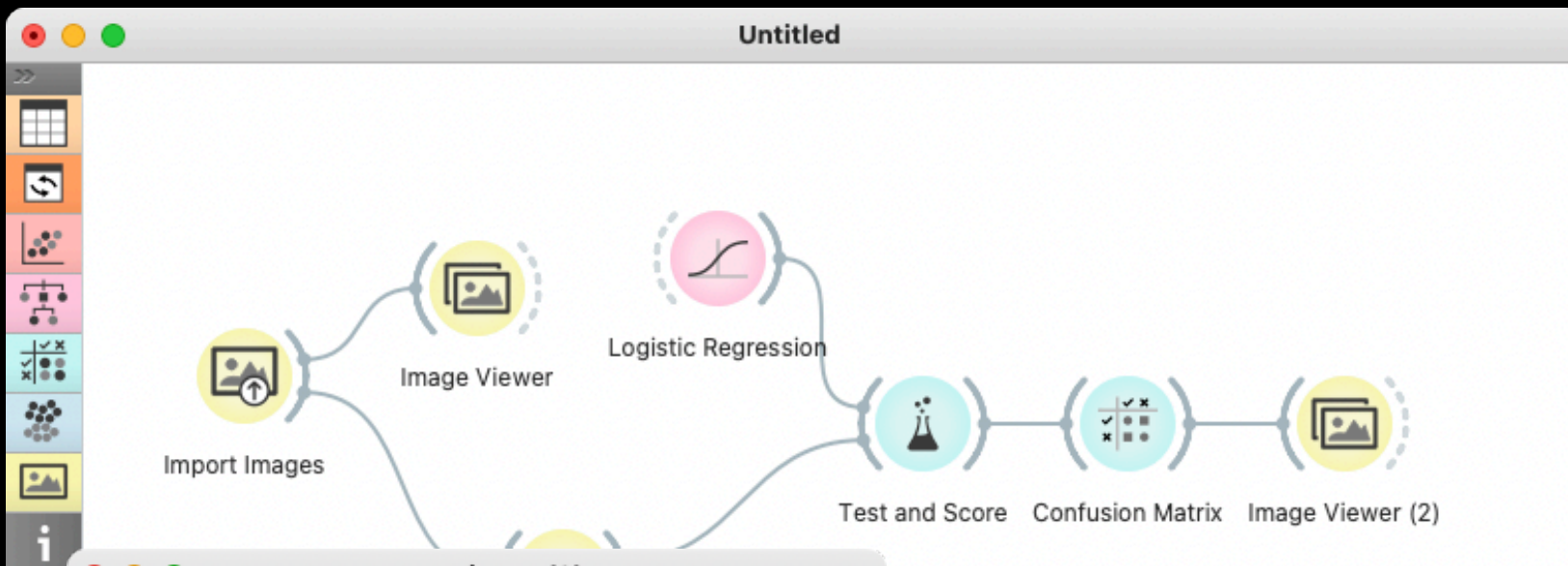
Confusion Matrix

Show: Number of instances

		Predicted			Σ
		chanel	dior	hermes	
Actual	chanel	6	4	0	10
	dior	2	8	0	10
	hermes	1	0	8	9
Σ		9	12	8	29

Select Correct Select Misclassified Clear Selection

? 📄 | → 1x29 ↔ 8 | 29



Confusion Matrix

Show: Number of instances

		Predicted			Σ
		chanel	dior	hermes	
Actual	chanel	6	4	0	10
	dior	2	8	0	10
	hermes	1	0	8	9
Σ		9	12	8	29

Select Correct Select Misclassified Clear Selection

1x29 8 | 29



purses-test



chanel-1.jpeg

JPEG image - 6 KB

Information

[Show More](#)

Created Monday, 5 June 2017 at 20:49

Modified Monday, 5 June 2017 at 20:49

Dimensions 225 x 225

Tags

Add Tags...



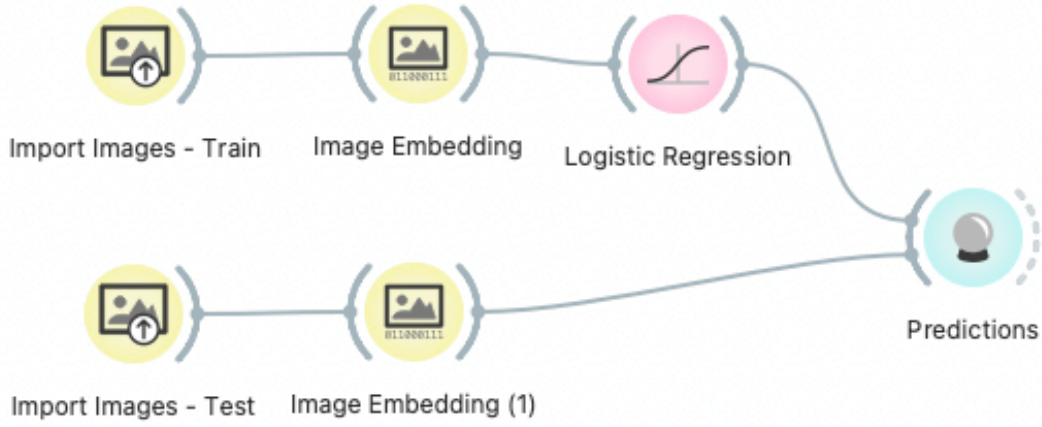
Rotate Left

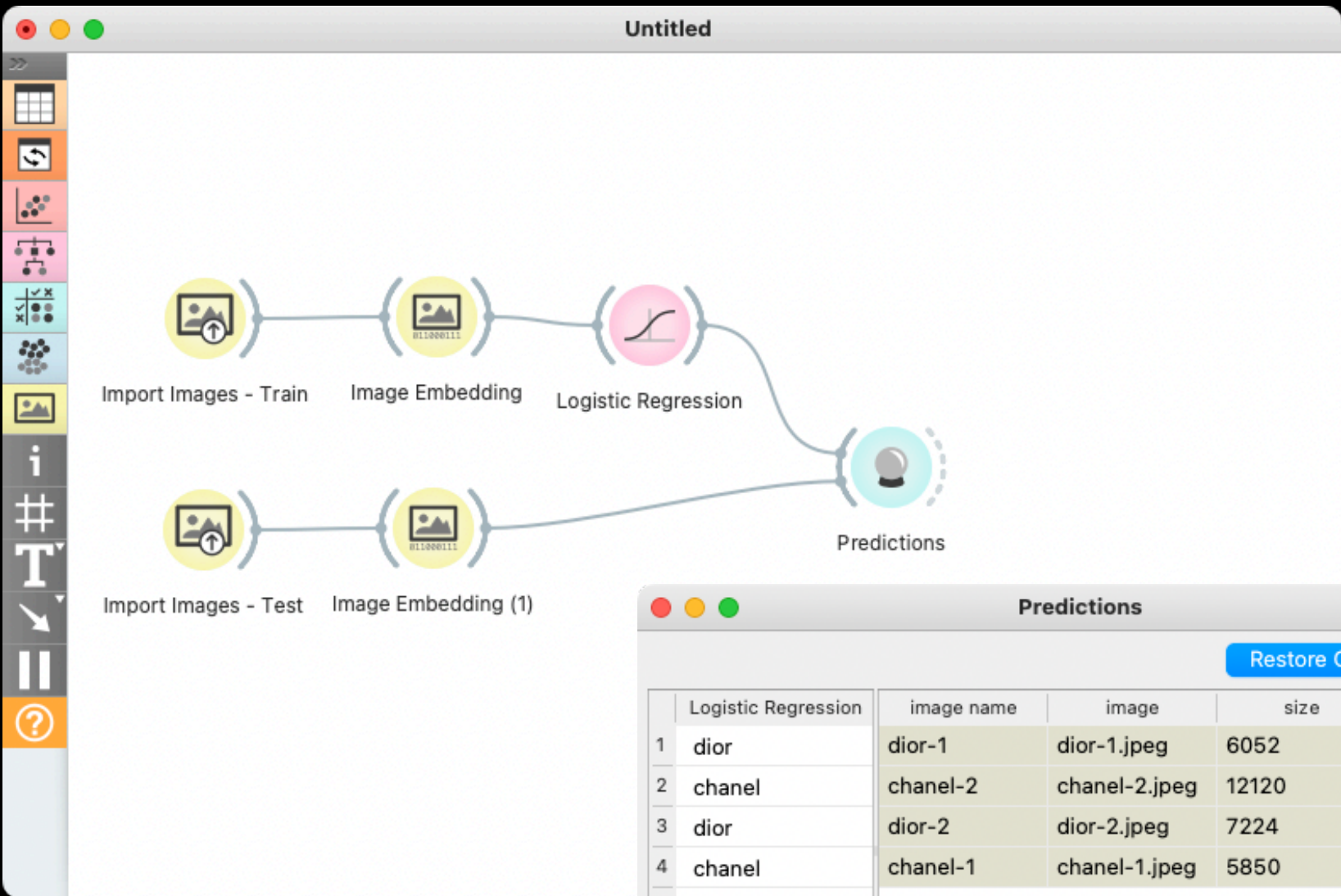


Markup



More...





Predictions

[Restore Original Order](#)

	Logistic Regression	image name	image	size	width
1	dior	dior-1	dior-1.jpeg	6052	194
2	chanel	chanel-2	chanel-2.jpeg	12120	291
3	dior	dior-2	dior-2.jpeg	7224	183
4	chanel	chanel-1	chanel-1.jpeg	5850	225

? | 4 | 4 | -

Concepts Covered in 15 min

Data representation

Distance estimation

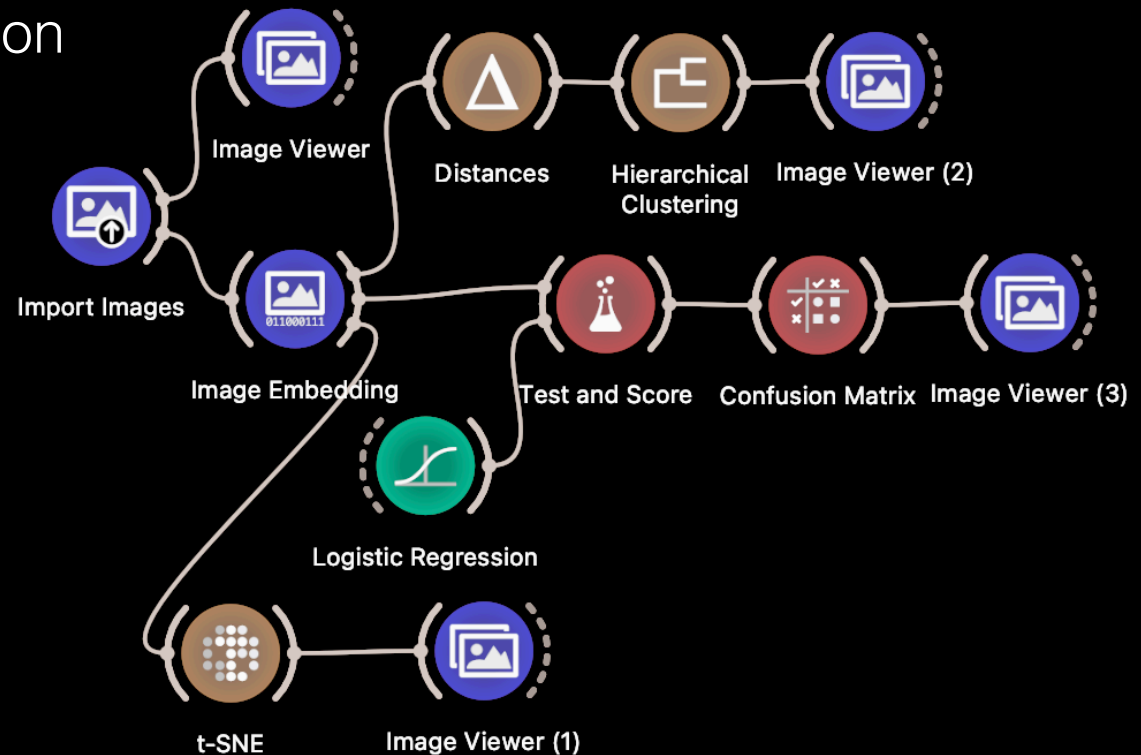
Clustering & Cluster explanation

Data embedding

Classification

Accuracy estimation

Prediction



AI Training & Schools

Can we train concepts of AI in schools?

At which levels?

How?

Houston

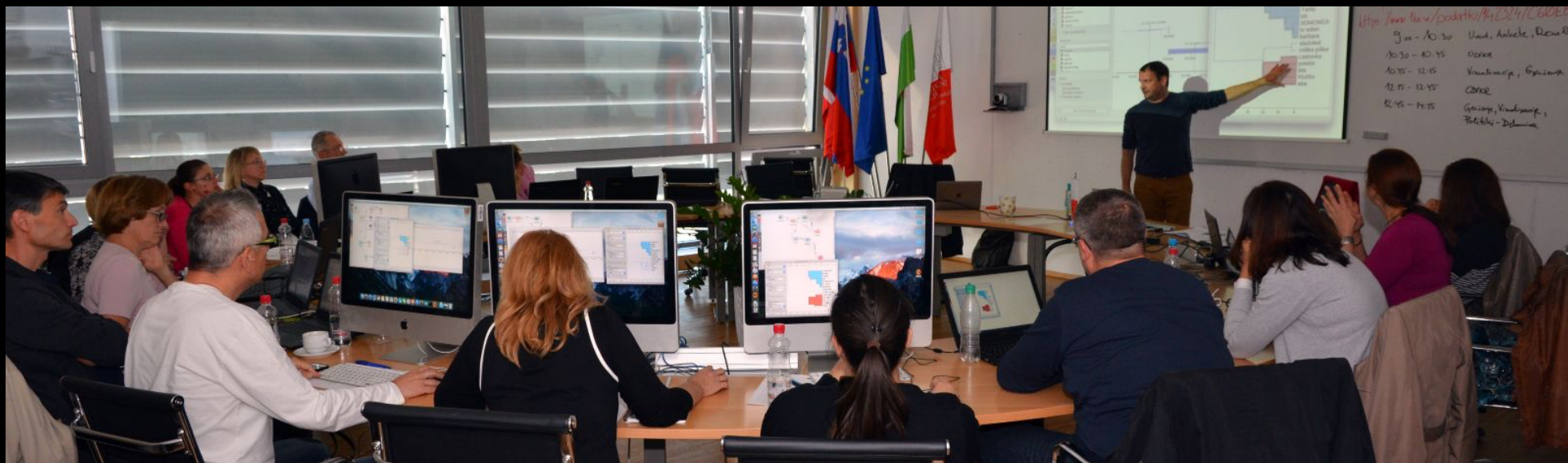


Kolkata



Pavia

one of over ten different workshops for public administration



a workshop for telecom agency

Partnership with Google.org

20 elementary and high schools in Slovenia

Design ten different two-hour workshops

Carry out 40 workshops

Train-the-trainer workshops

Long-term support of trainers

Image Viewer



maple



maple



maple



maple



maple



maple



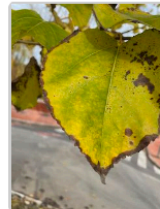
maple



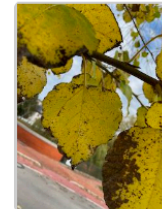
maple



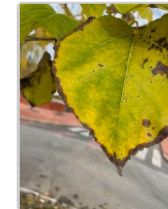
maple



black poplar



black poplar



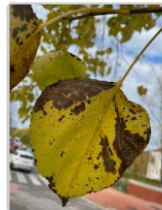
black poplar



black poplar



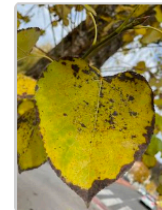
black poplar



black poplar



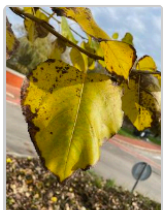
black poplar



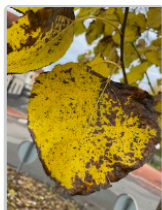
black poplar



black poplar



black poplar



black poplar



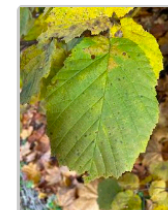
hazel



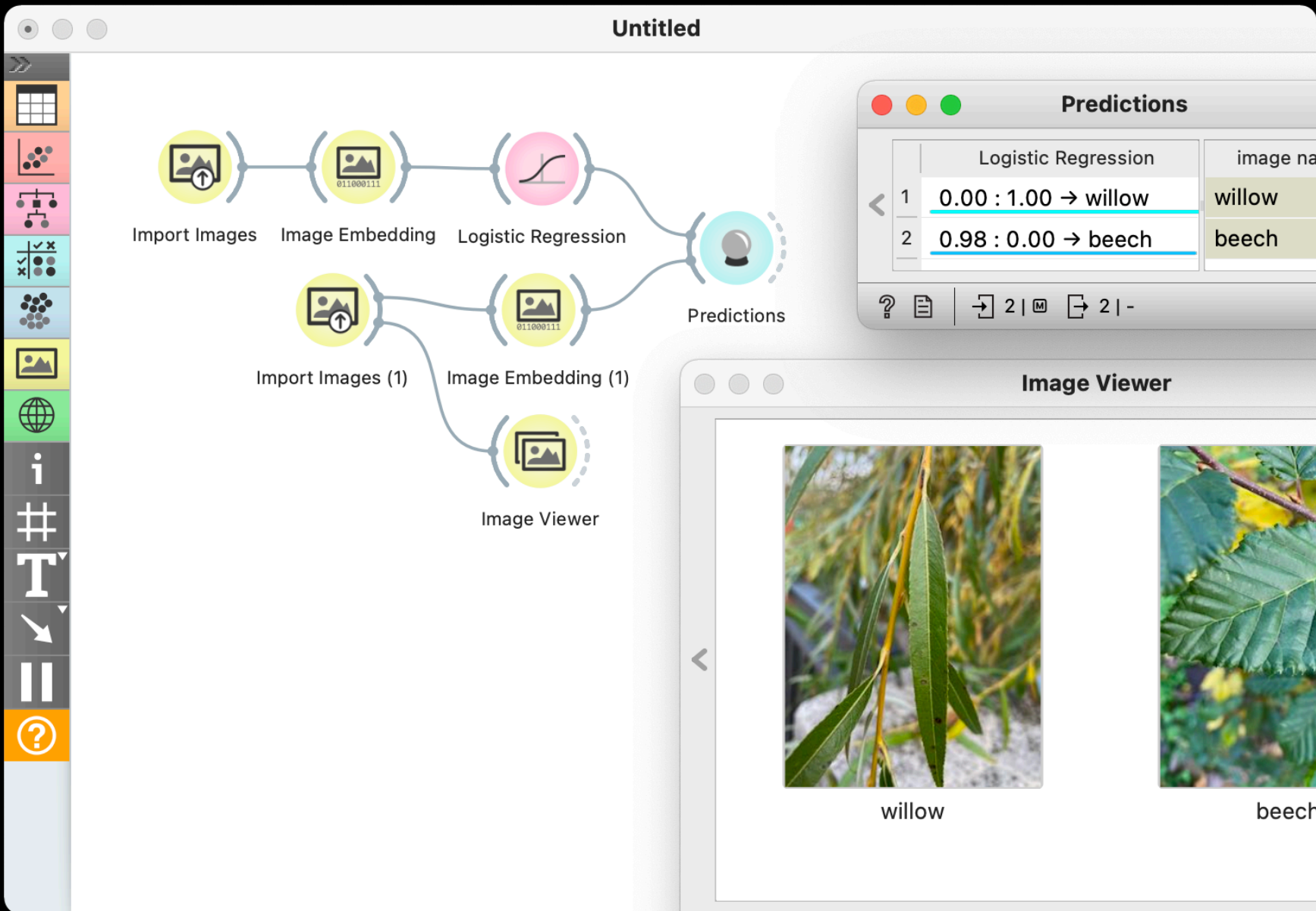
hazel



hazel



hazel

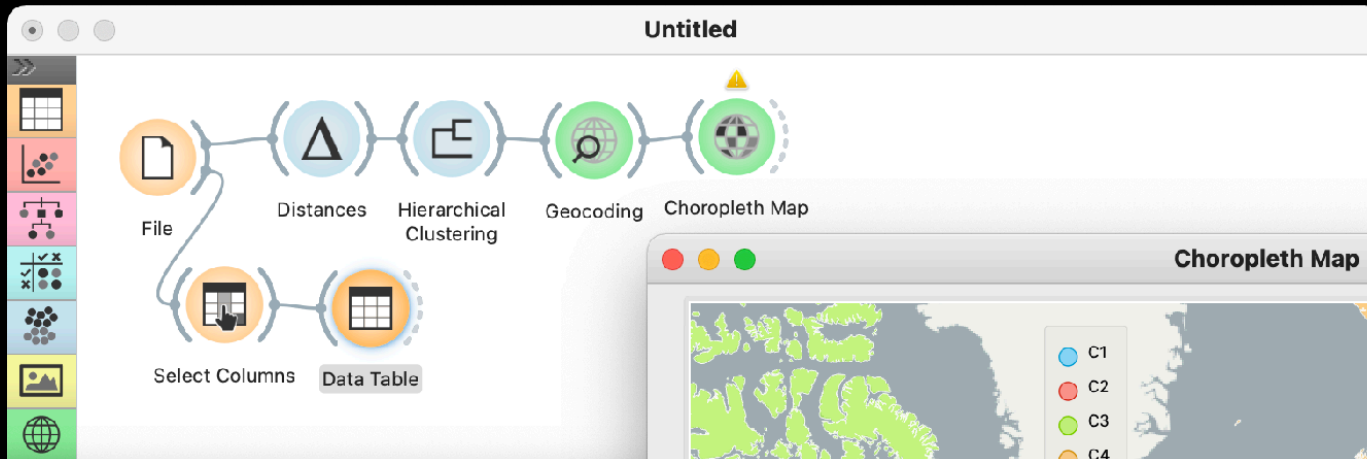


Predictions

	Logistic Regression	image name
1	0.00 : 1.00 → willow	willow
2	0.98 : 0.00 → beech	beech

? | | 2 | 2 | -

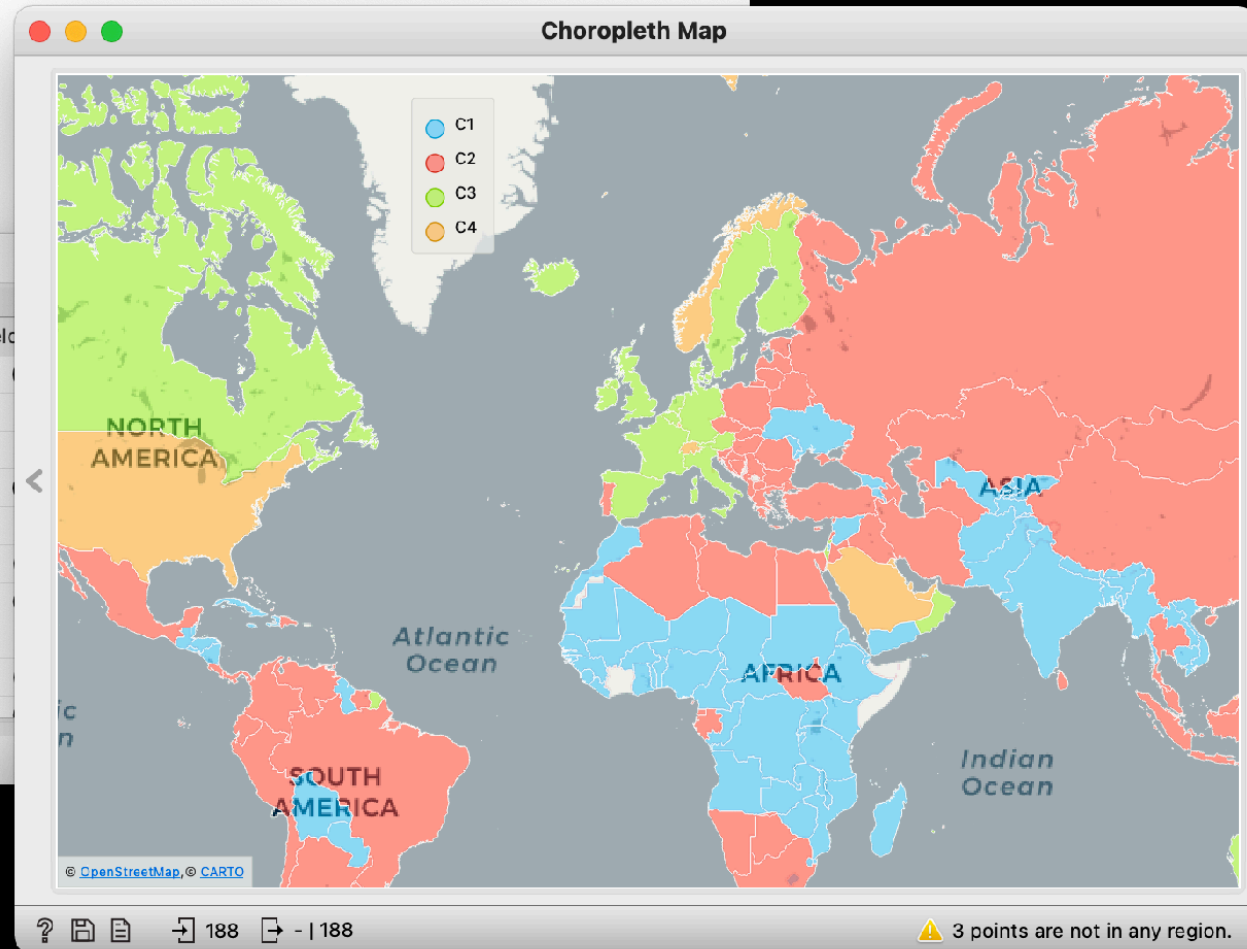




Data Table

	Country	Life expectancy	an years of schoo	nal income (GNI	elc
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	
10	Canada	82.2	13.1	42582	

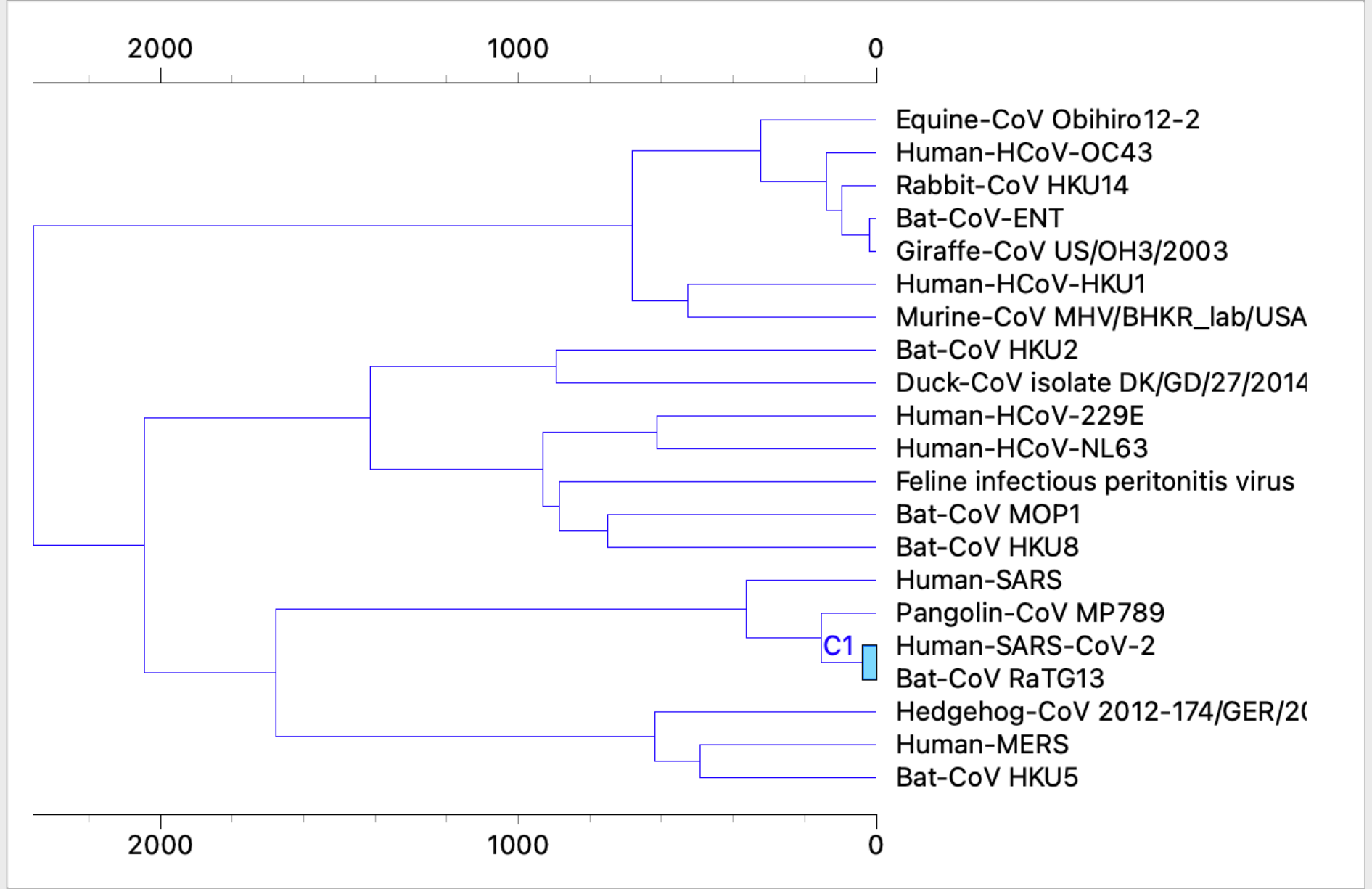
188 188 | 188



Data

	Virus	Sequence
1	Human-SARS-CoV-2	ATGTTTGT TTTTCTTGTTT TATTGCCACTAGTCTCTAGTCAGTGTGTTAATCTTACAAC...
2	Human-SARS	ATGTTTAT TTTTCTTATTAT TTTCTTACTCTCACTAGTGGTAGTGACCTTGACCGGTGCAC...
3	Human-MERS	ATGATACACTCAGTGT TTTCTACTGATGTTCTTGTTAACACCTACAGAAAGTTACGTTGAT...
4	Human-HCoV-OC43	ATGTTTTTGATAC TTTTAATTTCC T TACCAACGGCTTTTGCTGTTATAGGAGATTAAA...
5	Human-HCoV-229E	ATGTTTGT TTTTGCTTGTTGCATATGCCTTGTTGCATATTGCTGGTTGTCAAAC TACAAA...
6	Human-HCoV-NL63	ATGAAAC TTTTCTTGAT TTTGCTTGTTT GCCCTGGCCTCTTGCTTTTTCACATGTA...
7	Human-HCoV-HKU1	ATGTTATTAATTAT TTTTATTTTGCCTACAACATTAGCTGTTATAGGTGATTTTAATTGTA...
8	Bat-CoV MOP1	ATGCTTTTCAT TTTATGCATTGCATTGTGTTTAATTTTGT CAGTGCCAATATTGGTTGT...
9	Bat-CoV HKU8	ATGAAATCT TTTACTTGTCTTAAGCCTTTTGGCCTTGTTGGCCACATTGTCTGTCAATG...
10	Bat-CoV HKU2	ATGAAAC TTTTATAGT TTTTGTGCTCCTTTT TAGGGTGTGTTATTGCTGTGACTATGT...
11	Bat-CoV HKU5	ATGATACGCTCAGTGT TAGTACTGATGTGCTCGTTAACTTTTATAGGAAACCTCACAAG...
12	Bat-CoV RaTG13	ATGTTTGT TTTTCTTGTTT TATTGCCACTAGTTTCTAGTCAGTGTGTTAATCTAACAAC...
13	Bat-CoV-ENT	ATGTTTTTGATAC TTTTAATTTCC T TACCAACGGCTTTTGCTGTTATAGGAGATTAAA...
14	Hedgehog-CoV 2012-174/GER/2012	ATGATACGCTCAGCGTGTCTACTGATGTGCTTGTTAATGTTTATAAAAGCAACCCCAAG...
15	Pangolin-CoV MP789	ATGTTGT TTTTCTTCTTTT TACACTTGCCTTAGTAAATTCACAATGTGTTAATTTAAC...
16	Rabbit-CoV HKU14	ATGTTTTTGATAC TTTTAATTTCC T TACCAACGGCTTTTGCTGTTATAGGTGATTTAAA...
17	Duck-CoV isolate DK/GD/27/2014	ATGTTGGCAACGTTAG TTTTGTGGACGACAGTTTGTGTTGCTAATCCATGTTTAAC...
18	Feline infectious peritonitis virus	ATGATTGTGCTCGTAACTTGCCTCTTGTTGTTATGTTTCATACCACACAGTTTGTAGTAC...
19	Giraffe-CoV US/OH3/2003	ATGTTTTTGATAC TTTTAATTTCC T TACCAACGGCTTTTGCTGTTATAGGAGATTAAA...
20	Murine-CoV MHV/BHKR_lab/USA/icA...	ATGCTGTTCTGTTTATTCTAT TTTTGCCTCTTGCTTAGGGTATATTGGTGATTTTAG...
21	Equine-CoV Obihiro12-2	ATGGTCTTATTACT TTTATTTT TCCCTACCTACCGCTCTTGCTGTTGTAGGAGATGTAAA...

Hierarchical Clustering

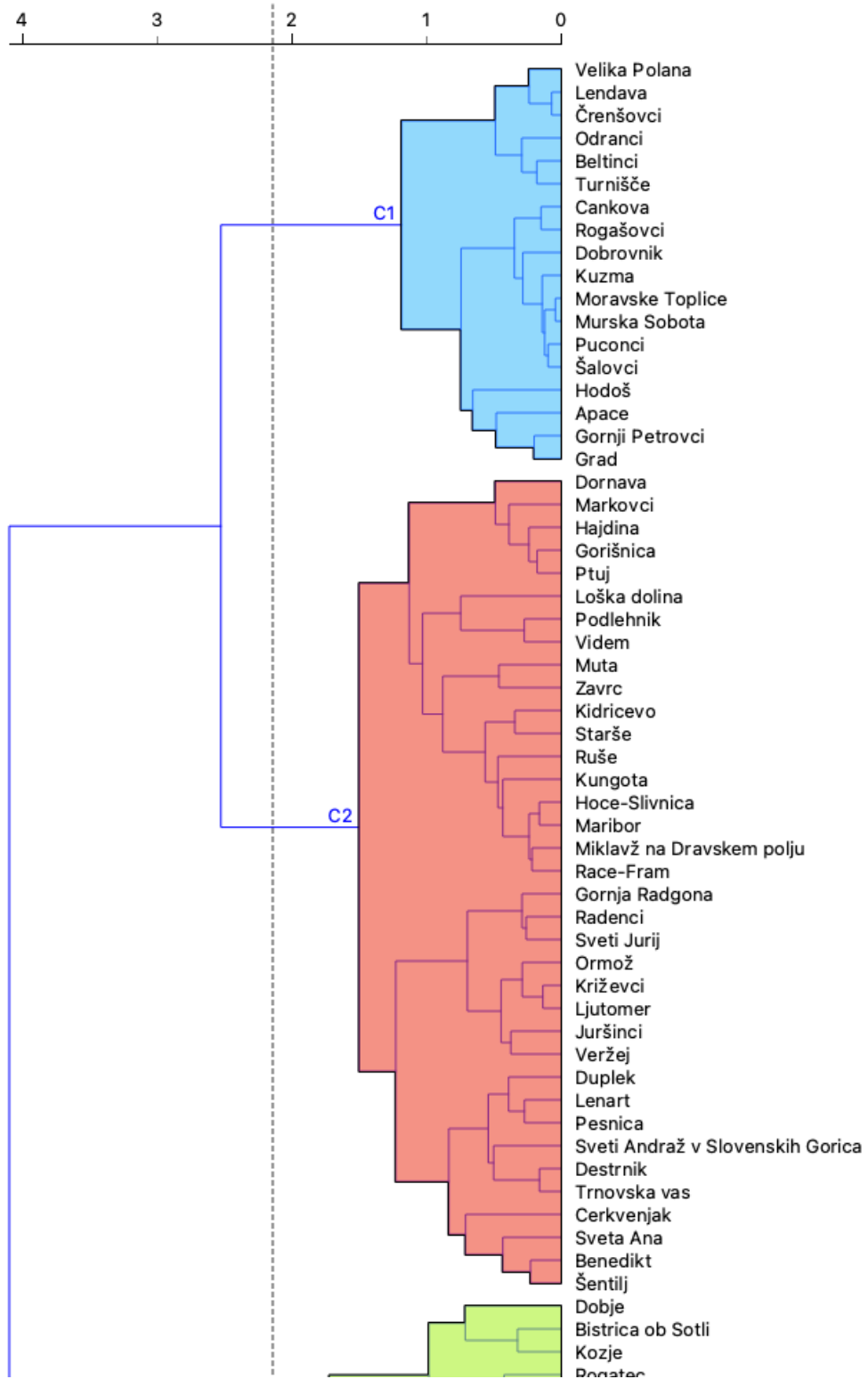


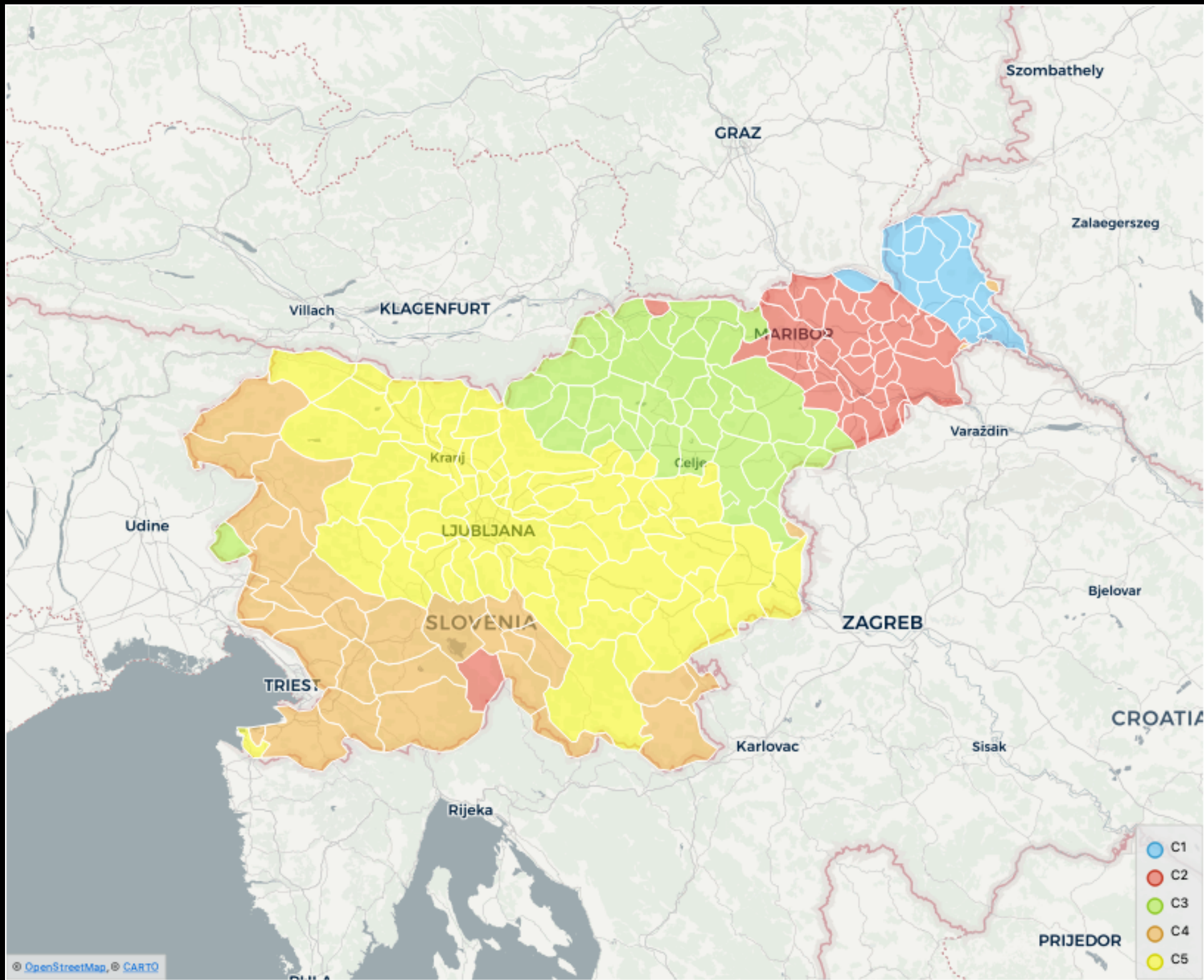
family names

Data Table

	občina	AMBROŽIČ	BABIČ	BAJC	BERGANT	BEVC	BEZJAK	BIZJAK	BLATNIK	BLAŽIČ	BOGATAJ	BOŽIČ	BREGAR
1	Ajdovščina	7	1	60	2	0	0	74	0	5	2	36	0
2	Apace	0	1	0	0	0	1	0	0	2	2	1	0
3	Beltinci	0	2	0	0	0	1	0	0	0	0	1	0
4	Benedikt	0	0	0	0	0	0	0	0	0	0	0	0
5	Bistrica ob S...	0	0	0	0	5	0	0	0	1	0	0	2
6	Bled	42	1	5	4	0	0	9	1	3	0	7	0
7	Bloke	0	0	0	0	0	0	1	0	0	0	0	1
8	Bohinj	0	0	1	0	1	0	4	0	0	2	1	0
9	Borovnica	1	0	0	0	0	0	6	0	1	1	2	1
10	Bovec	0	1	0	0	0	0	10	0	0	0	0	0
11	Braslovce	1	1	0	2	0	1	17	7	1	2	5	0
12	Brda	6	0	0	0	0	0	6	0	13	0	2	0
13	Brezovica	5	5	0	1	1	0	6	0	2	2	4	5
14	Brežice	3	3	1	2	5	0	11	3	6	0	9	1
15	Cankova	0	1	0	0	0	0	0	0	0	0	0	0
16	Celje	0	5	5	1	19	2	18	8	4	4	29	3
17	Cerklje na G...	0	0	0	5	0	0	0	0	0	0	0	0
18	Cerknica	0	0	8	0	0	0	4	0	1	2	1	0
19	Cerkno	7	0	0	0	0	0	7	0	0	6	21	0
20	Cerkvenjak	0	1	0	0	0	2	0	0	2	0	0	0
21	Crnomelj	3	16	0	0	0	0	0	0	7	0	3	0
22	Destrnik	0	0	0	0	0	1	0	0	0	0	1	0

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Teaching lessons
with a pinch of
artificial intelligence



Beri naprej →

AKTIVNOSTI

Primeri aktivnosti, ki uporabljajo pristope umetne inteligence v povezavi z redno učno snovjo. Posamezna aktivnost vsebuje kratek opis vsebine, povezavo z učnim načrtom, podroben opis učne ure, podatke za delo z gradivi ter videe. Določene aktivnosti so primerne za osnovne, druge za srednje šole. Uporabite filter za prikaz določenega tipa aktivnosti.

Vse

Osnovna šola

Srednja šola



Določevalni ključi za skupine živali

Utrjevanje razlikovanja med skupinami živali

naravoslovje in tehnologija



Družbeno-ekonomske značilnosti držav

Opazovanje držav glede na družbeno-ekonomske značilnosti

geografija



Podnebni pasovi Evrope

Raziskovanje podnebnih pasov Evrope

geografija



Podobnost narečnih skupin

Ugotavljanje podobnosti slovenskih narečnih skupin

slovenščina







Orange Data Mining

The screenshot shows the Orange Data Mining website homepage. At the top, the browser address bar displays "orangedatamining.com". The navigation menu includes "Screenshots", "Workflows", "Download", "Blog", "Docs", and "Workshops", along with a search icon. The main heading is "orange" with a stylized "g" that looks like a pair of glasses. Below this, the text reads "Fruitful and Fun" and "Open source machine learning and data visualization. Build data analysis workflows visually, with a large, diverse toolbox." A prominent orange button labeled "Download Orange" is visible. To the right, a cartoon illustration features a large orange character with glasses and a white document character, surrounded by several smaller, colorful characters holding icons representing different data analysis tasks. Below the main content, there are three featured blog posts, each with a date, title, and a "Read more >" link. The first post is dated "Aug 13, 2021" and titled "Why You Should Use Apply Domain", accompanied by a scatter plot with red, blue, and green points. The second post is dated "Aug 5, 2021" and titled "Box Plot Alternative: Violin Plot", accompanied by two violin plots, one blue and one red. The third post is dated "Jun 17, 2021" and titled "PCA vs. MDS vs. t-SNE", accompanied by a scatter plot showing data points forming a shape resembling the map of Europe.

orange

Screenshots Workflows Download Blog Docs Workshops

Fruitful and Fun

Open source machine learning and data visualization.
Build data analysis workflows visually, with a large, diverse toolbox.

Download Orange

Aug 13, 2021
Why You Should Use Apply Domain
Apply Domain is a mystery widget with an amazing functionality. [Read more >](#)

Aug 5, 2021
Box Plot Alternative: Violin Plot
Violin plot can tell you more than a box plot. [Read more >](#)

Jun 17, 2021
PCA vs. MDS vs. t-SNE
Oh, the joy and variety of data embedding and projection techniques! [Read more >](#)

An open and free toolbox for Data Science.

Orange Data Mining

1.000.000 lines of Python code

20 years of development

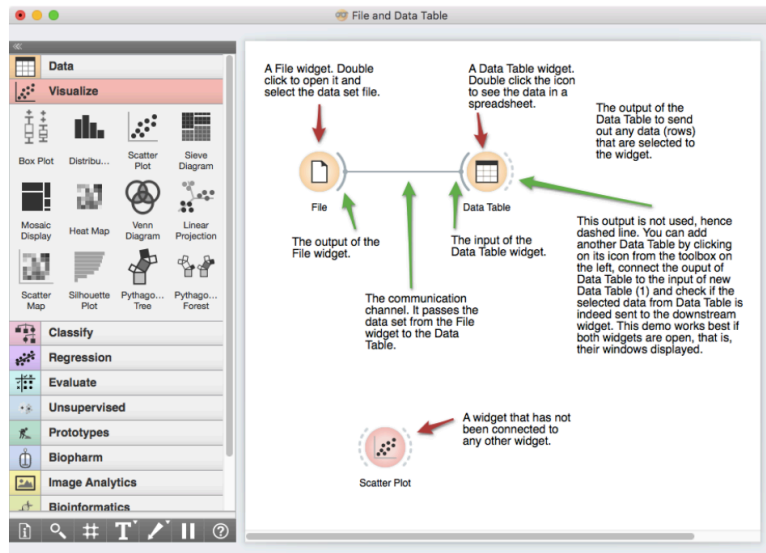
~500.000 users from both industry & academia

~500 universities use it for teaching data science

Lecture Notes

Lesson 1: Workflows in Orange

Orange workflows consist of components that read, process and visualize data. We call them “widgets”. Widgets are placed on a drawing board (the “canvas”). Widgets communicate by sending information along a communication channel. Output from one widget is used as input to another.

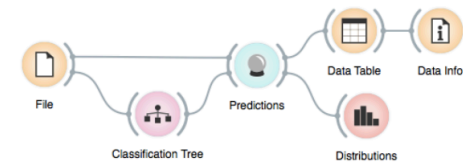


A simple workflow with two connected widgets and one widget without connections. The outputs of a widget appear on the right, while the inputs appear on the left.

We construct workflows by dragging widgets onto the canvas and connecting them by drawing a line from the transmitting widget to the receiving widget. The widget's outputs are on the right, and the inputs on the left. In the workflow above, the File widget sends data to the Data Table widget.

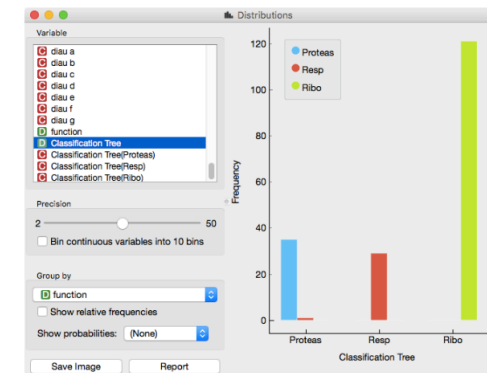
Lesson 6: Classification Accuracy

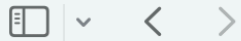
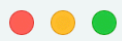
Now that we know what classification trees are, the next question is what is the quality of their predictions. For beginning, we need to define what we mean by quality. In classification, the simplest measure of quality is classification accuracy expressed as the proportion of data instances for which the classifier correctly guessed the value of the class. Let's see if we can estimate, or at least get a feeling for, classification accuracy with the widgets we already know.



Let us try this schema with the brown-selected data set. The Predictions widget outputs a data table augmented with a column that includes predictions. In the Data Table widget, we can sort the data by any of these two columns, and manually select data instances where the values of these two features are different (this would not work on big data). Roughly, visually estimating the accuracy of predictions is straightforward in the Distribution widget, if we set the features in view appropriately.

The measuring of accuracy is such an important concept that it would require its own widget. But wait a while, there's educational value in reusing the widgets we already know.





youtube.com

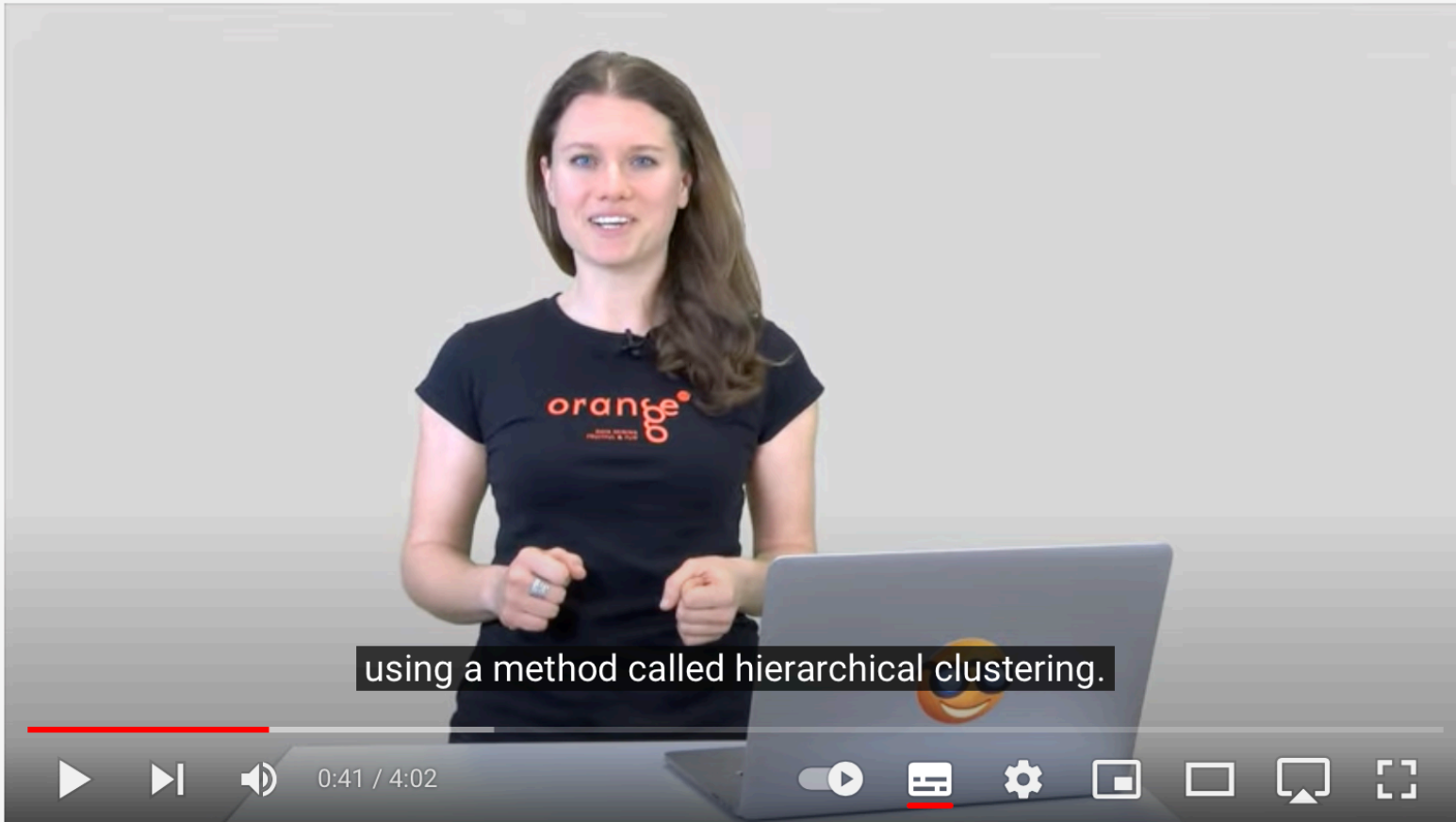


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Getting Started With Orange 05: Hierarchical Clustering

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Conclusion

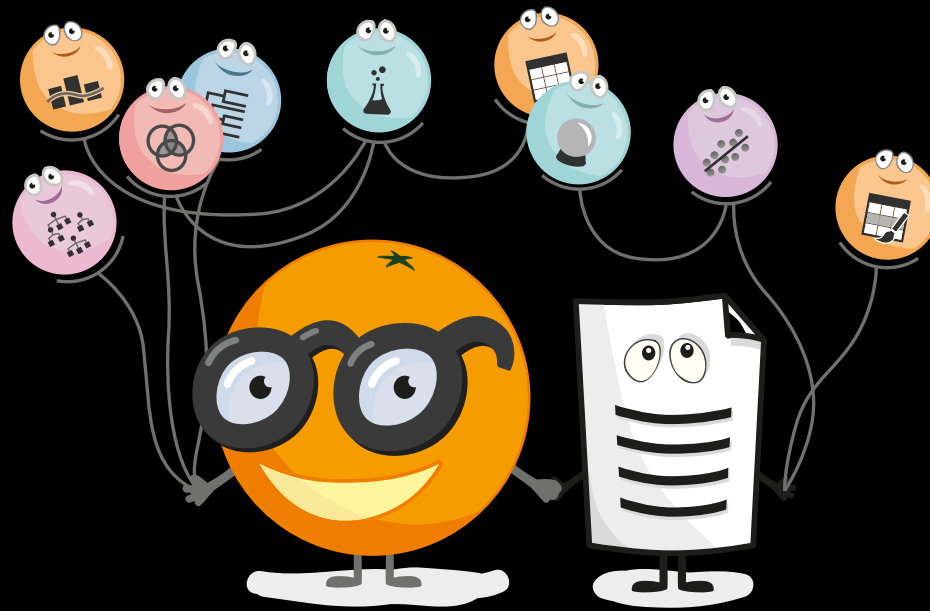
AI is a tool. The concepts behind it are simple.

For general audience, we should teach about its use, not its inner workings.

Training of AI should be practical.

We need to train the teachers first.

And we need to ask them where to start.



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