창의자율프로젝트

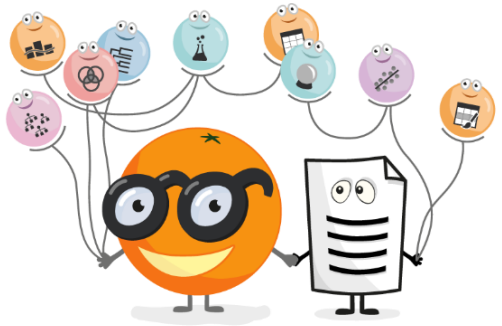
GIST AI대학원
AI Graduate School

Dr. HeeSuk Kim

REFERENCE SITE

https://orangedatamining.com/

https://orange3.readthedocs.io/projects/orange-visual-programming/en/latest/widgets/model/neuralnetwork.html



GIST AI대학원 Graduate School

REFERENCE SITE

Orange

Developer(s)	University of Ljubljana
Initial release	10 October 1996; 26 years ago[1]
Stable release	3.34.0[2] / 5 December 2022; 3 months ago
Repository	Orange Repository
Written in	Python, Cython, C++, C
Operating system	Cross-platform
Type	Machine learning, Data mining, Data visualization, Data analysis
License	GPLv3 or later[3][4]
Website	orangedatamining.com

Visual Programming Front-End 기능 제공

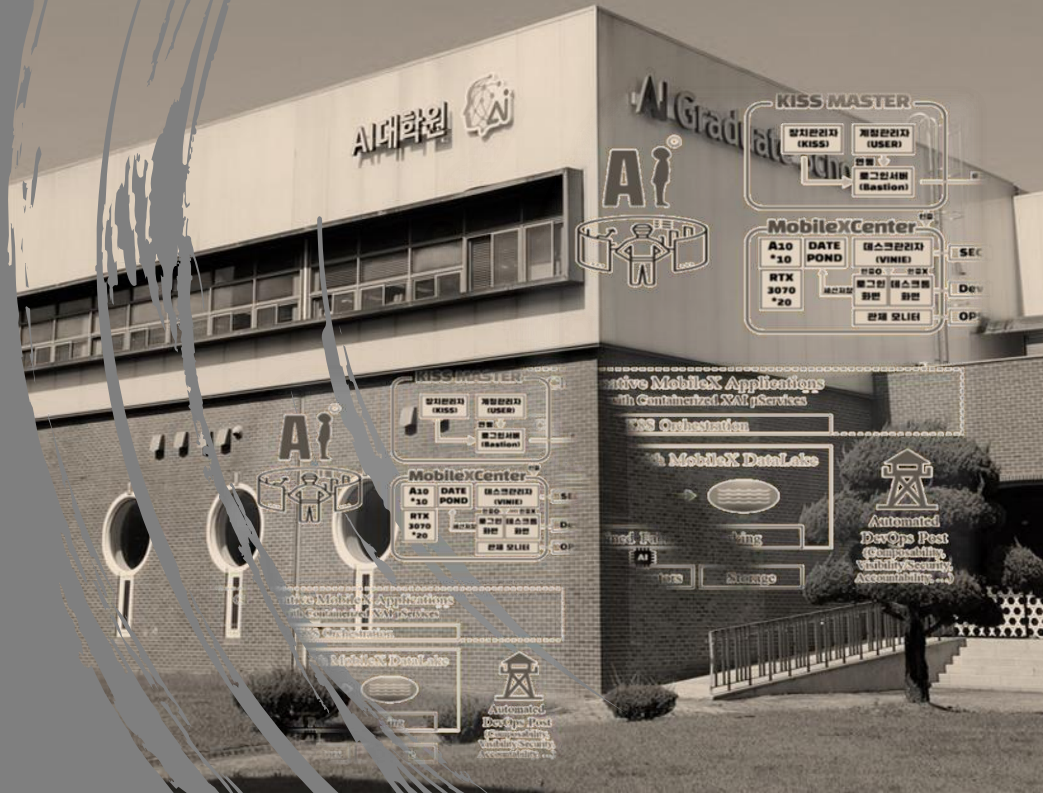
- Machine Learning
- Data Mining
- Data Visualization
- Data Analysis

CONTENTS

Orange Visual Programming

MobileX Station

1. Abalone flesh weight prediction using Linear Regression



Problem

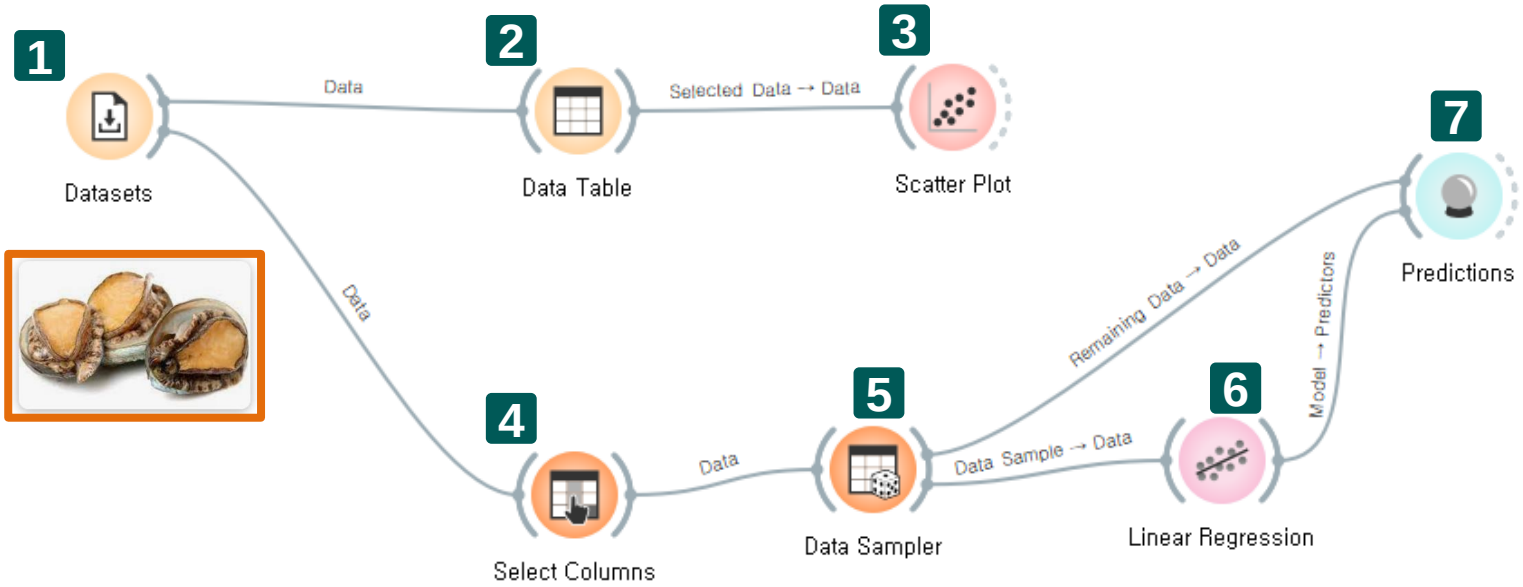
- 전복의 나이테, 성별, 길이, 직경, 두께, 전체 무게, 내장 무게, 껍질 무게에 해당하는 총 8가지 데이터를 입력하면 AI가 전복의 순살(flesh) 무게를 예측할 수 있을까?

Data Type

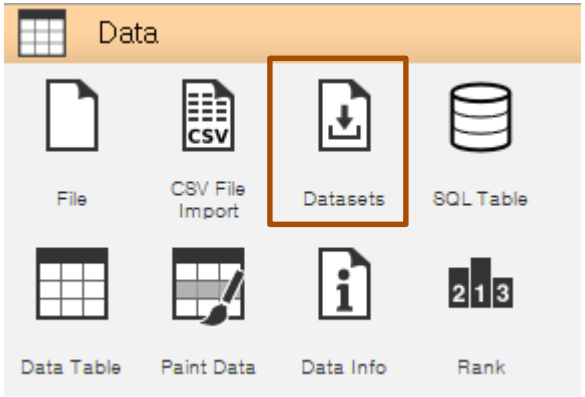
Structured data

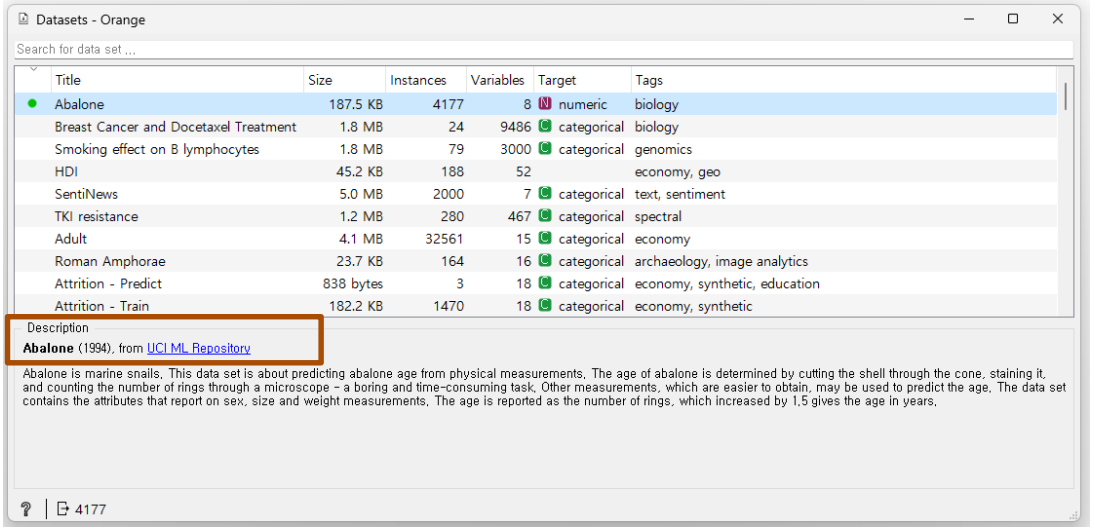
AI Model

Linear Regression

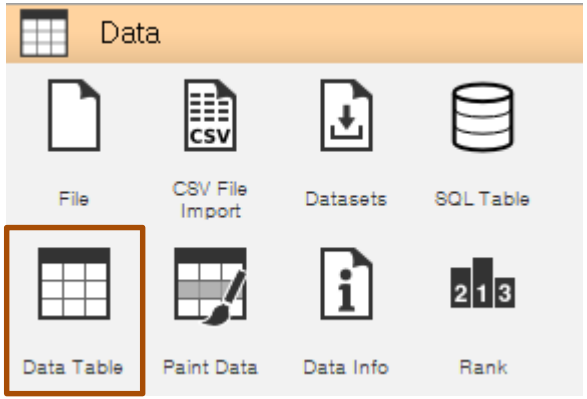


1 Datasets



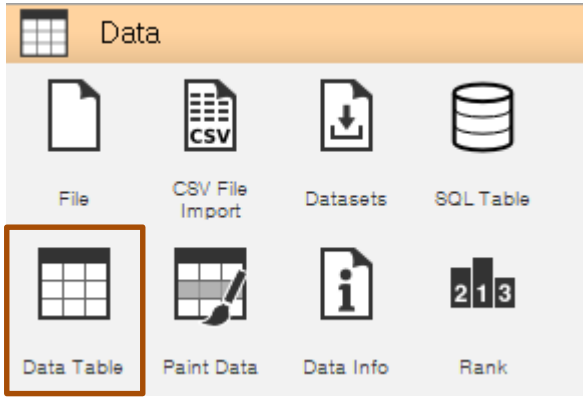


2 Data Table



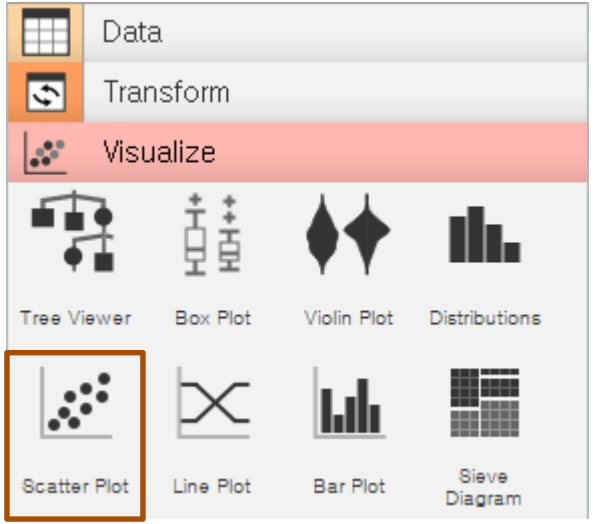
	Rings	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight
1	15	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.1500
2	7	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.0700
3	9	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.2100
4	10	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550
5	7	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.0550
6	8	I	0.425	0.300	0.095	0.3515	0.1410	0.0775	0.1200
7	20	F	0.530	0.415	0.150	0.7775	0.2370	0.1415	0.3300
8	16	F	0.545	0.425	0.125	0.7680	0.2940	0.1495	0.2600
9	9	M	0.475	0.370	0.125	0.5095	0.2165	0.1125	0.1650
10	19	F	0.550	0.440	0.150	0.8945	0.3145	0.1510	0.3200
11	14	F	0.525	0.380	0.140	0.6065	0.1940	0.1475	0.2100
12	10	M	0.430	0.350	0.110	0.4060	0.1675	0.0810	0.1350
4168	9	M	0.500	0.380	0.125	0.5770	0.2690	0.1265	0.1535
4169	8	F	0.515	0.400	0.125	0.6150	0.2865	0.1230	0.1765
4170	10	M	0.520	0.385	0.165	0.7910	0.3750	0.1800	0.1815
4171	10	M	0.550	0.430	0.130	0.8395	0.3155	0.1955	0.2405
4172	8	M	0.560	0.430	0.155	0.8675	0.4000	0.1720	0.2290
4173	11	F	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490
4174	10	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605
4175	9	M	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080
4176	10	F	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960
4177	12	M	0.710	0.555	0.195	1.9485	0.9455	0.3765	0.4950

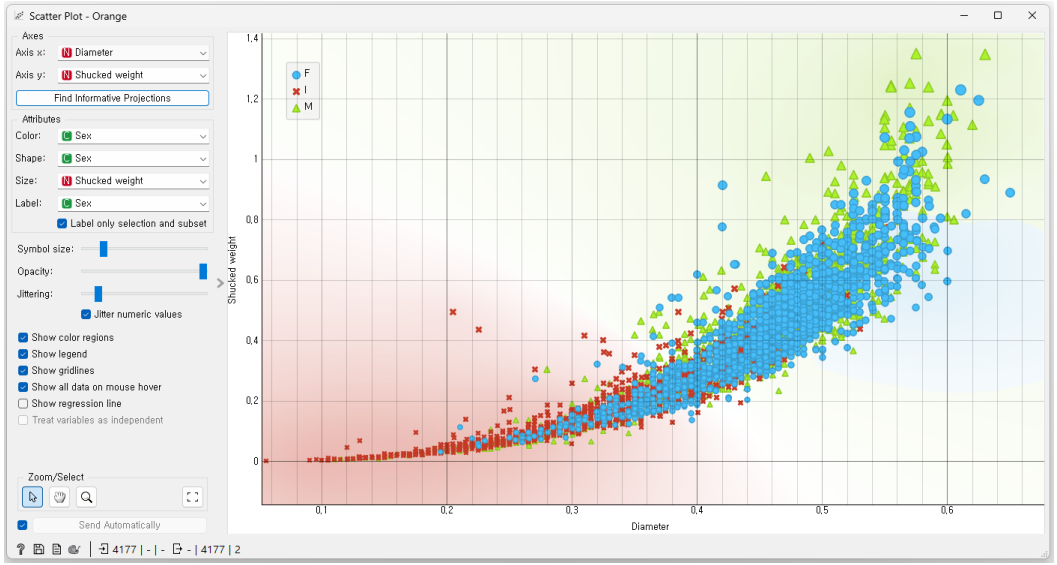
2 Data Table



Attribute name	Attribute
Rings	나이테: 연도를 나타냄.
Sex	성별: M(수), F(암), I(유아)
Length	길이: 최장 껍질 측정(mm)
Diameter	직경: 길이에 수직(mm)
Height	두께: 껍질과 살 포함(mm)
Whole weight	전체 무게: 그램 단위(g)
Shucked weight	**순살 무게: 그램 단위(g)**
Viscera weight	내장 무게: 피를 뺀 후 장 무게(g)
Shell weight	껍질 무게: 건조 후(g)

3 Scatter Plot





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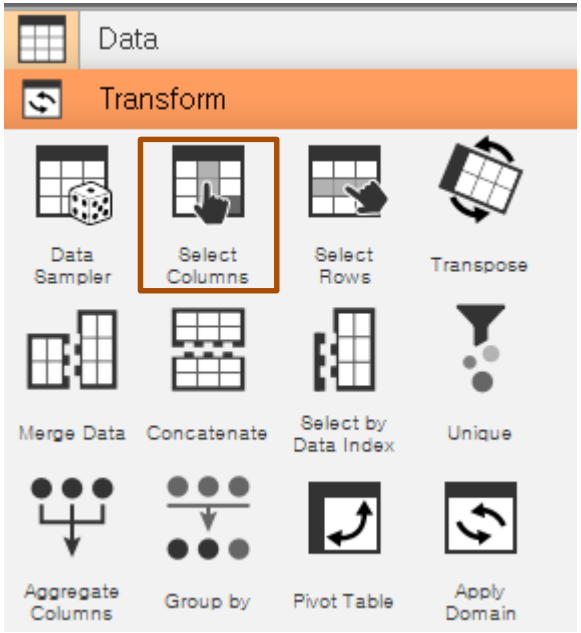
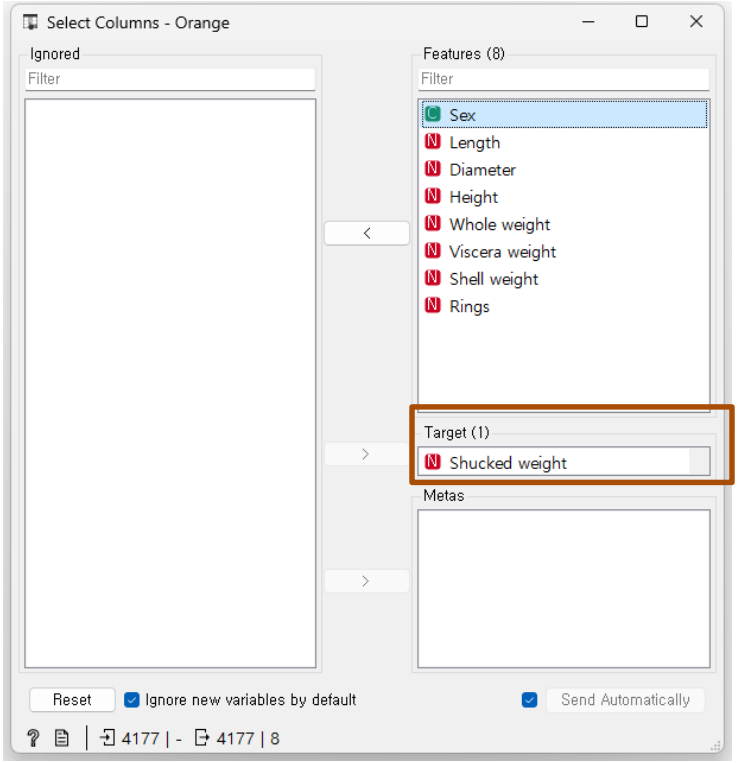
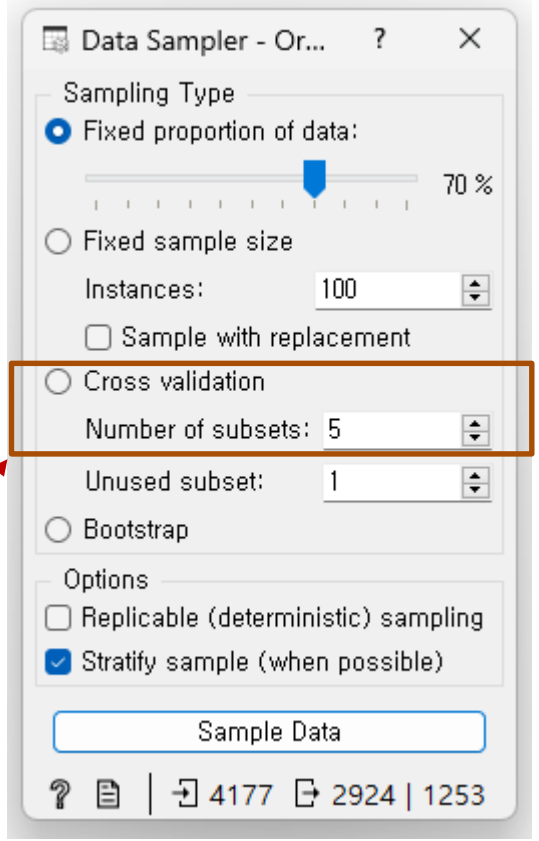


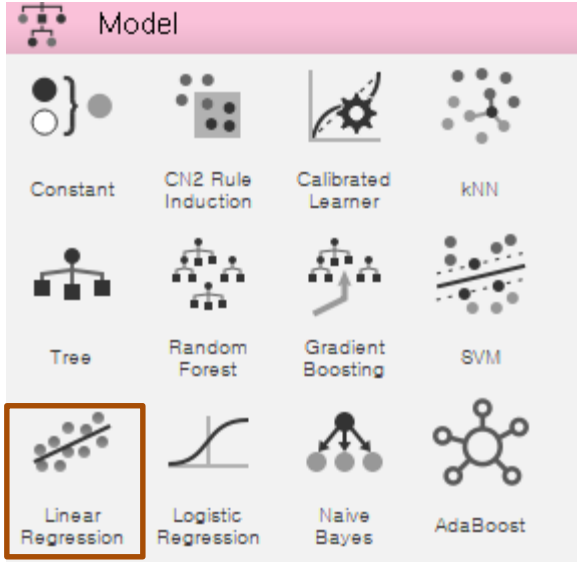


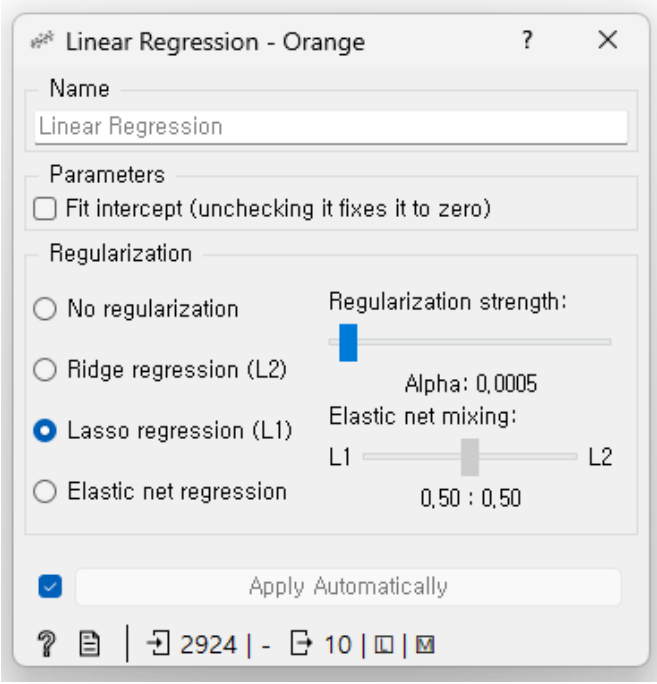
5 Data Sampler



- Cross validation:
  Stratified K-fold Cross Validation

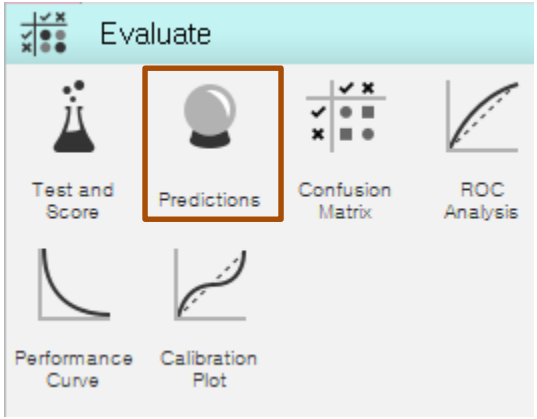
6 Linear Regression

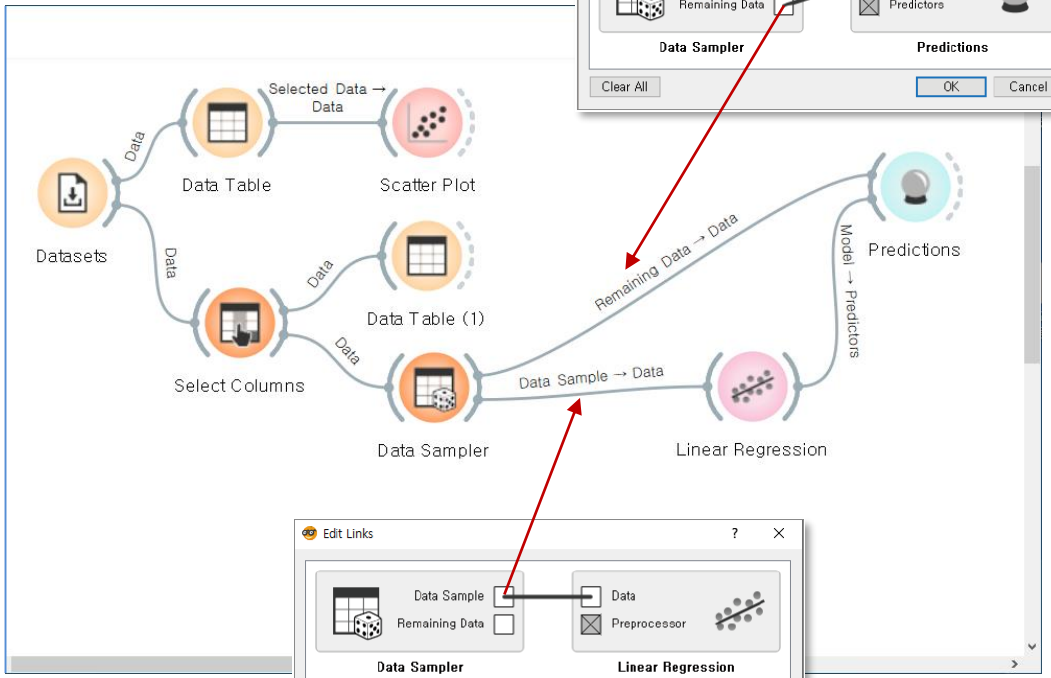




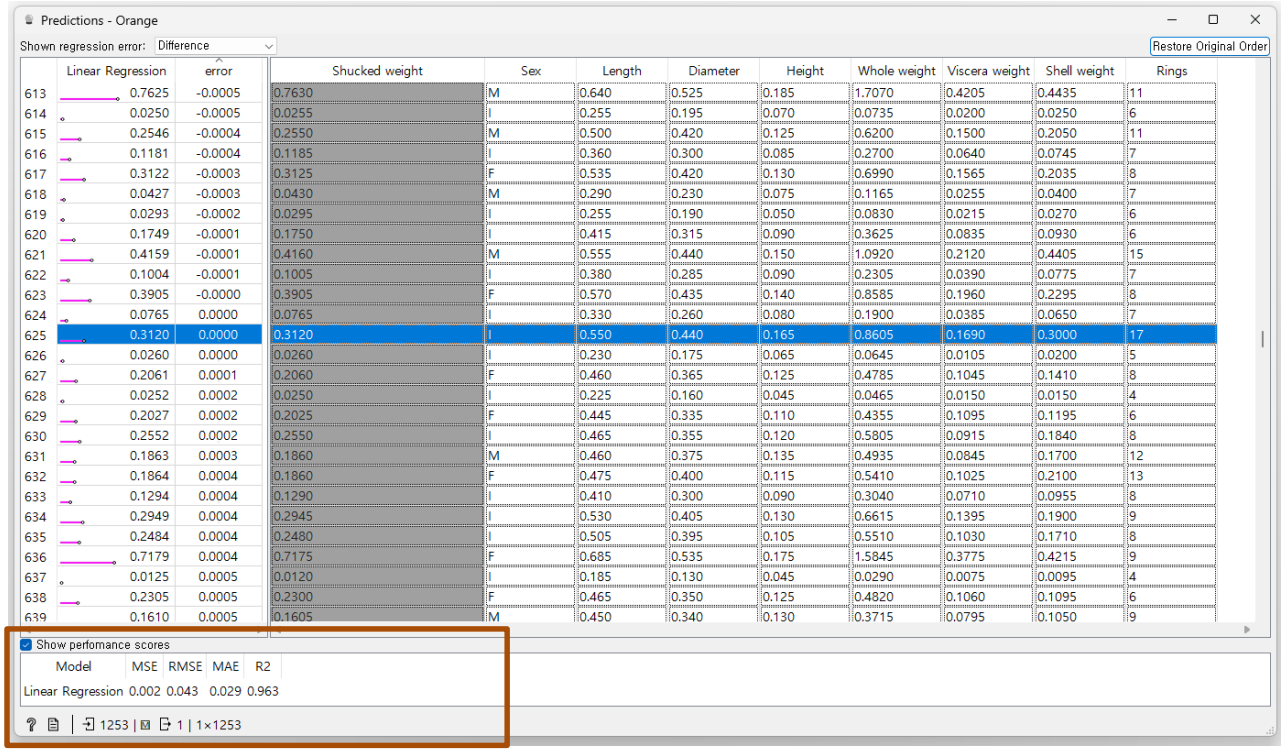
- Regularization
  - Ridge regression(L2): 각 계수의 제곱을 더하는 방식
  - Lasso regression(L1): 각 계수의 절댓값을 더하는 방식
  - Elastic net regression: L2와 L1 방식을 절충한 것

7 Predictions





7 Predictions



	Linear Regression	error	Shucked weight	Sex	Length	Diameter	Height	Whole weight	Viscera weight	Shell weight	Rings
613	0.7625	-0.0005	0.7630	M	0.640	0.525	0.185	1.7070	0.4205	0.4435	11
614	0.0250	-0.0005	0.0255	I	0.255	0.195	0.070	0.0735	0.0200	0.0250	6
615	0.2546	-0.0004	0.2550	M	0.500	0.420	0.125	0.6200	0.1500	0.2050	11
616	0.1181	-0.0004	0.1185	I	0.360	0.300	0.085	0.2700	0.0640	0.0745	7
617	0.3122	-0.0003	0.3125	F	0.535	0.420	0.130	0.6990	0.1565	0.2035	8
618	0.0427	-0.0003	0.0430	M	0.290	0.230	0.075	0.1165	0.0255	0.0400	7
619	0.0293	-0.0002	0.0295	I	0.255	0.190	0.050	0.0830	0.0215	0.0270	6
620	0.1749	-0.0001	0.1750	I	0.415	0.315	0.090	0.3625	0.0835	0.0930	6
621	0.4159	-0.0001	0.4160	M	0.555	0.440	0.150	1.0920	0.2120	0.4405	15
622	0.1004	-0.0001	0.1005	I	0.380	0.285	0.090	0.2305	0.0390	0.0775	7
623	0.3905	-0.0000	0.3905	F	0.570	0.435	0.140	0.8585	0.1960	0.2295	8
624	0.0765	0.0000	0.0765	I	0.330	0.260	0.080	0.1900	0.0385	0.0650	7
625	0.3120	0.0000	0.3120	I	0.550	0.440	0.165	0.8605	0.1690	0.3000	17
626	0.0260	0.0000	0.0260	I	0.230	0.175	0.065	0.0645	0.0105	0.0200	5
627	0.2061	0.0001	0.2060	F	0.460	0.365	0.125	0.4785	0.1045	0.1410	8
628	0.0252	0.0002	0.0250	I	0.225	0.160	0.045	0.0465	0.0150	0.0150	4
629	0.2027	0.0002	0.2025	F	0.445	0.335	0.110	0.4355	0.1095	0.1195	6
630	0.2552	0.0002	0.2550	I	0.465	0.355	0.120	0.5805	0.0915	0.1840	8
631	0.1863	0.0003	0.1860	M	0.460	0.375	0.135	0.4935	0.0845	0.1700	12
632	0.1864	0.0004	0.1860	F	0.475	0.400	0.115	0.5410	0.1025	0.2100	13
633	0.1294	0.0004	0.1290	I	0.410	0.300	0.090	0.3040	0.0710	0.0955	8
634	0.2949	0.0004	0.2945	I	0.530	0.405	0.130	0.6615	0.1395	0.1900	9
635	0.2484	0.0004	0.2480	I	0.505	0.395	0.105	0.5510	0.1030	0.1710	8
636	0.7179	0.0004	0.7175	F	0.685	0.535	0.175	1.5845	0.3775	0.4215	9
637	0.0125	0.0005	0.0120	I	0.185	0.130	0.045	0.0290	0.0075	0.0095	4
638	0.2305	0.0005	0.2300	F	0.465	0.350	0.125	0.4820	0.1060	0.1095	6
639	0.1610	0.0005	0.1605	M	0.450	0.340	0.130	0.3715	0.0795	0.1050	9

- Performance Evaluation
  - MSE(Mean Squared Error)
  - RMSE(Root Mean Squared Error)
  - MAE(Mean Absolute Error)
  - R2(R Squared)

  MSE, RMSE, MAE는 0에 가까울수록, R2는 1에 가까울수록 정확도가 높음

Conclusion

- 전복의 나이테, 성별, 길이, 직경, 두께, 전체 무게, 내장 무게, 껍질 무게에 해당하는 총 8개의 변수와 전복 순살(flesh)의 상관 관계를 분석함
- Linear regression을 이용하여 8가지 변수 값에 따른 전복의 순살 무게를 예측함

MobileX Station

2. Star Terror Prevention Using Logistic Regression

Problem

- 상품평에 기록된 별(star)을 신뢰할 수 있을까?

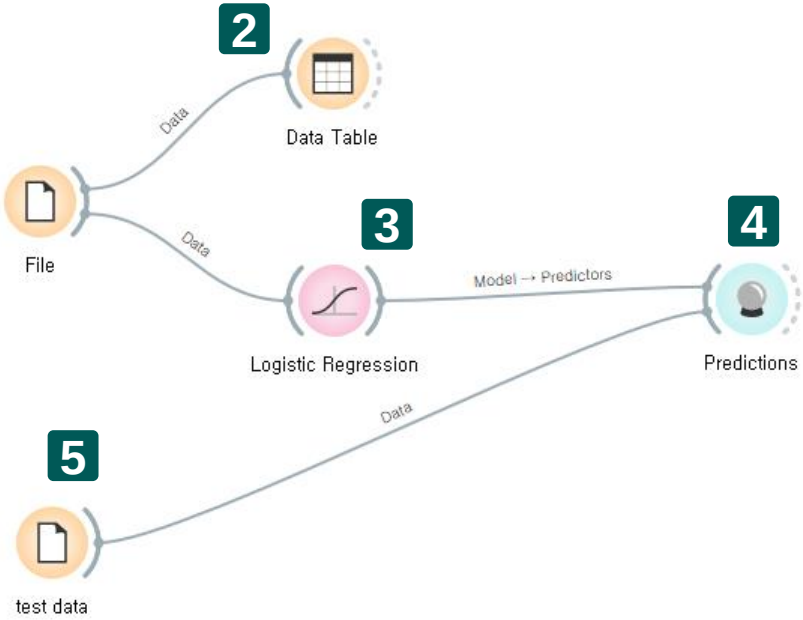
  신뢰할 수 없다면, AI가 신뢰할 수 있는 별을 제시할 수 있을까?

Data Type

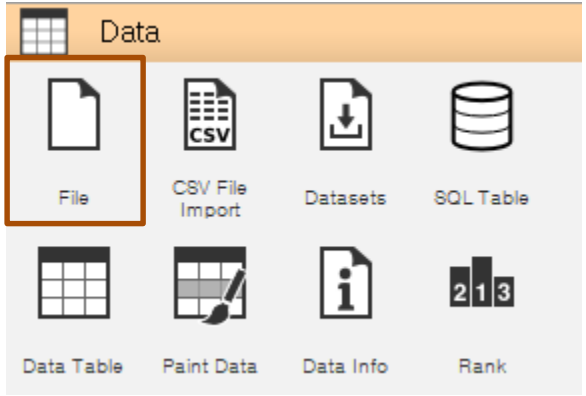
Structured data

AI Model

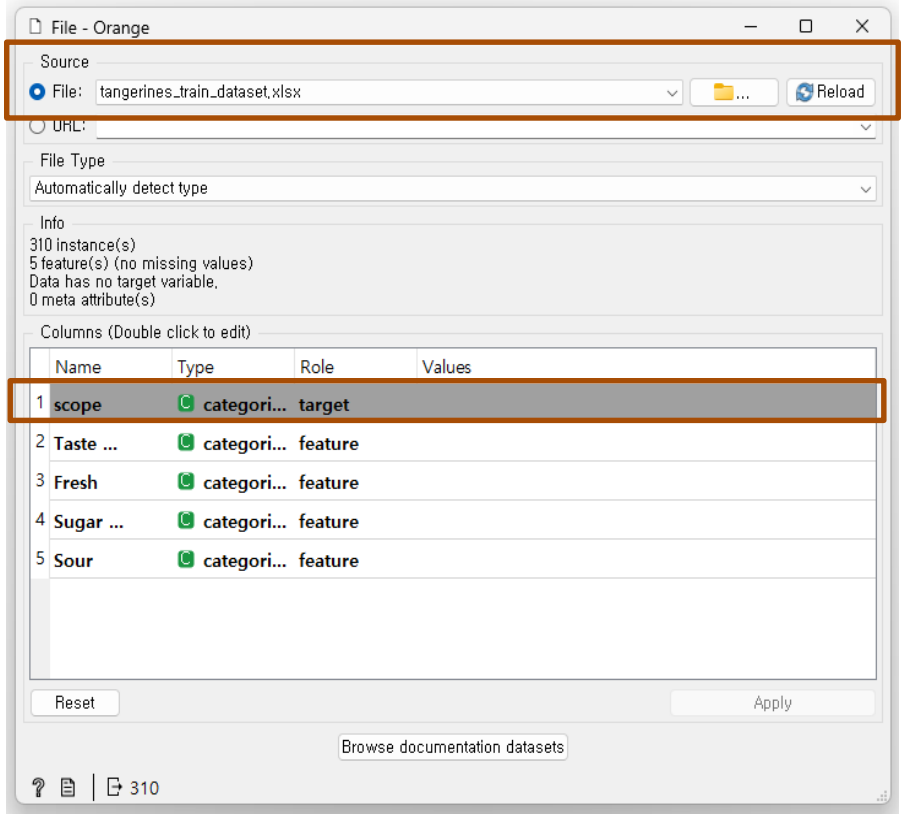
Multinomial Logistic Regression



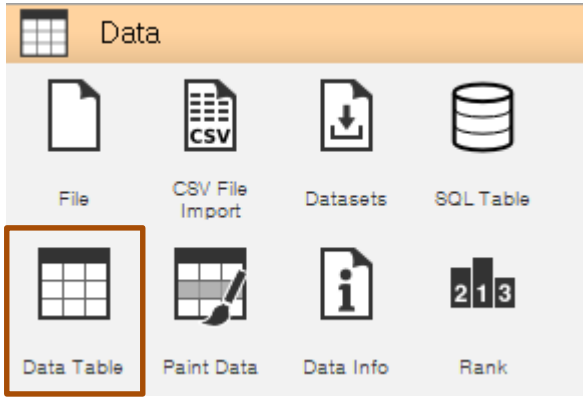
1 Datasets



- tangerines_train_dataset.xlsx
  (310 instances)
- tangerines_test_dataset.xlsx
  (15 instances)



2 Data Table



Data Table

Info
310 instances (no missing data)
5 features
No target variable.
No meta attributes

Variables
- [x] Show variable labels (if present)
- [ ] Visualize numeric values
- [x] Color by instance classes

Selection
- [x] Select full rows

Restore Original Order

Send Automatically

310 | 310 | 310

	scope	Taste satisfaction	Fresh	Sugar content	Sour
1	1	3	3	2	3
2	1	3	2	3	3
3	1	2	3	3	3
4	1	3	3	3	3
5	1	3	3	3	3
6	1	3	3	3	3
7	1	3	3	3	3
8	1	3	3	2	3
9	1	3	3	3	2
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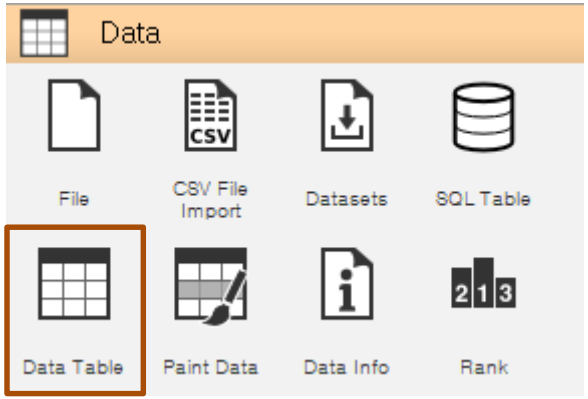
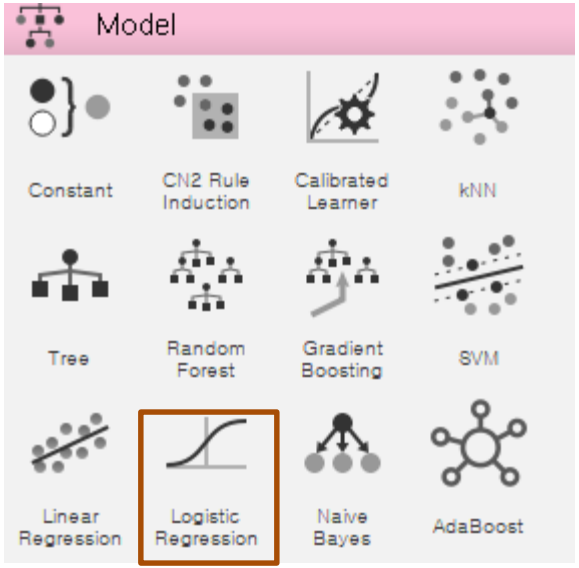
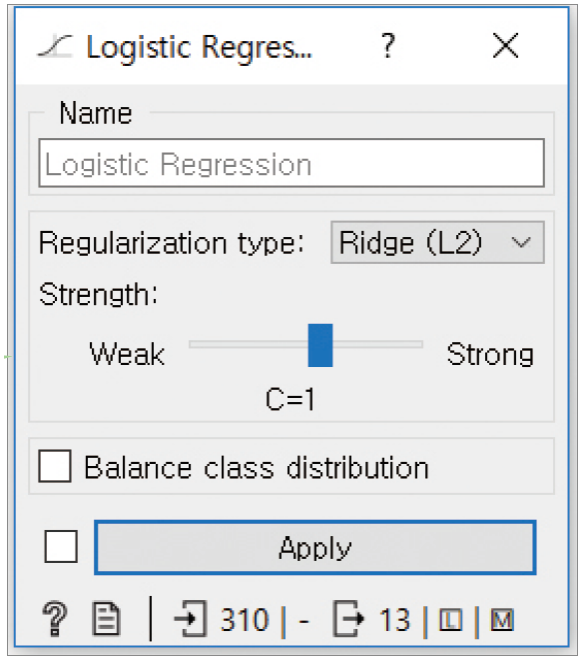
2 Data Table



Attribute name	Attribute
scope	종합 평점 (1~5: 점수가 높을수록 좋은 상품)
Taste satisfaction	맛 만족도 (1: 예상보다 맛있어요, 2: 괜찮아요, 3: 예상보다 맛이 없어요.)
Fresh	싱싱함 (1: 예상보다 싱싱해요, 2: 보통이에요, 3: 예상보다 싱싱하지 않아요.)
Sugar content	당도 (1: 아주 달콤해요, 2: 적당히 달아요, 3: 달지 않아요.)
Sour	새콤함 (1: 많이 새콤해요, 2: 적당히 새콤해요, 3: 새콤하지 않아요.)

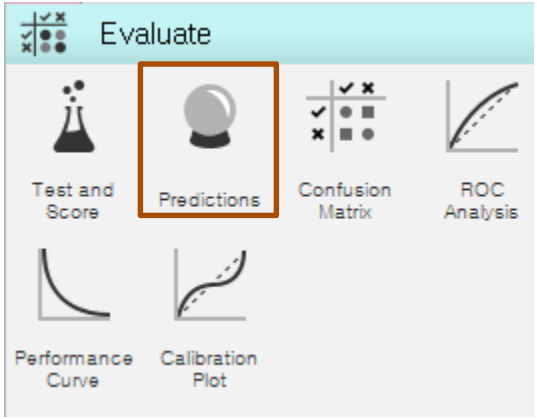
3 Logistic Regression

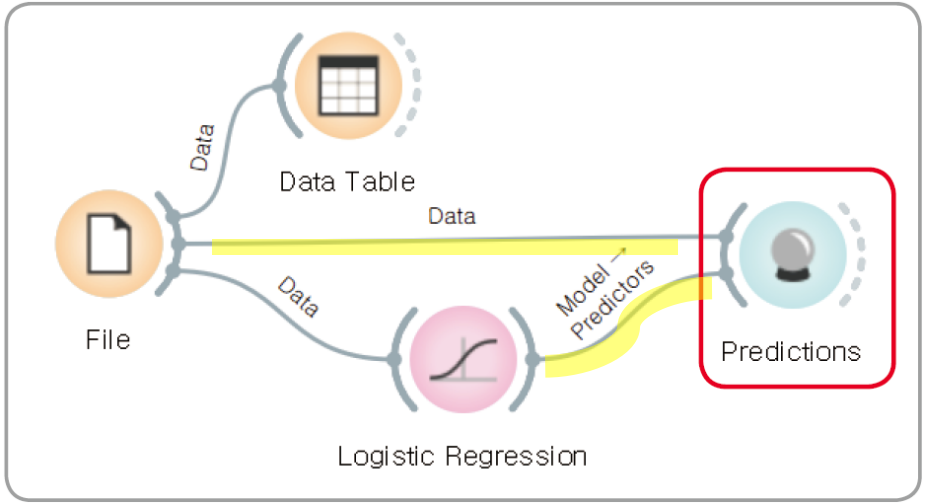




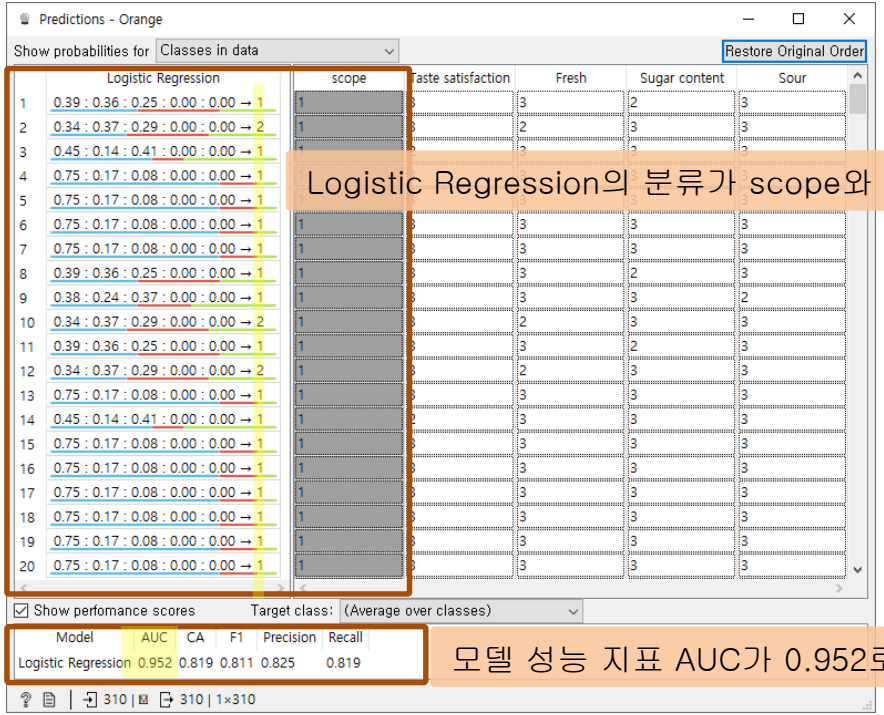
- Regularization
  - Ridge: 분류를 위한 식의 가중치 제곱의 합
  - Lasso: 분류를 위한 식의 가중치 절댓값의 합
  - Week Strong: 데이터를 분류할 때의 강도

4 Predictions





4 Predictions

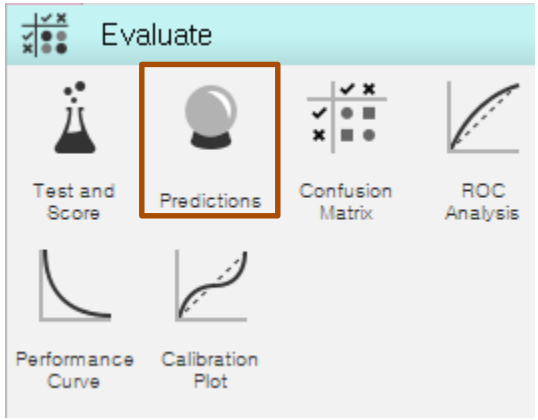


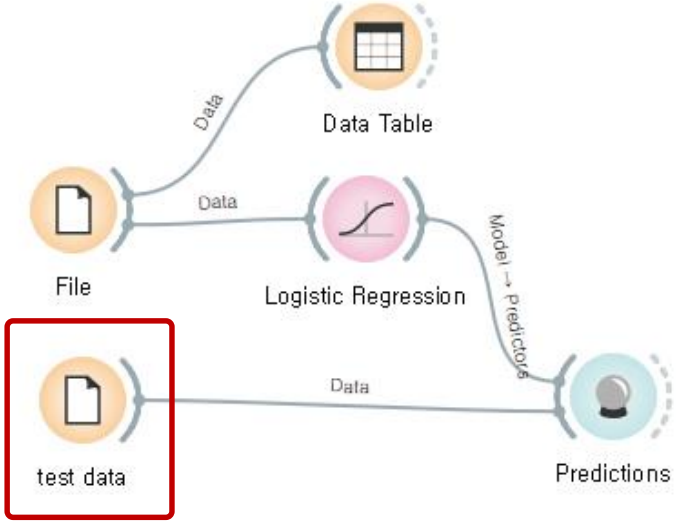
Logistic Regression의 분류가 scope와 유사

모델 성능 지표 AUC가 0.952로 매우 높은 정확도를 보여줌(AUC: 0~1)

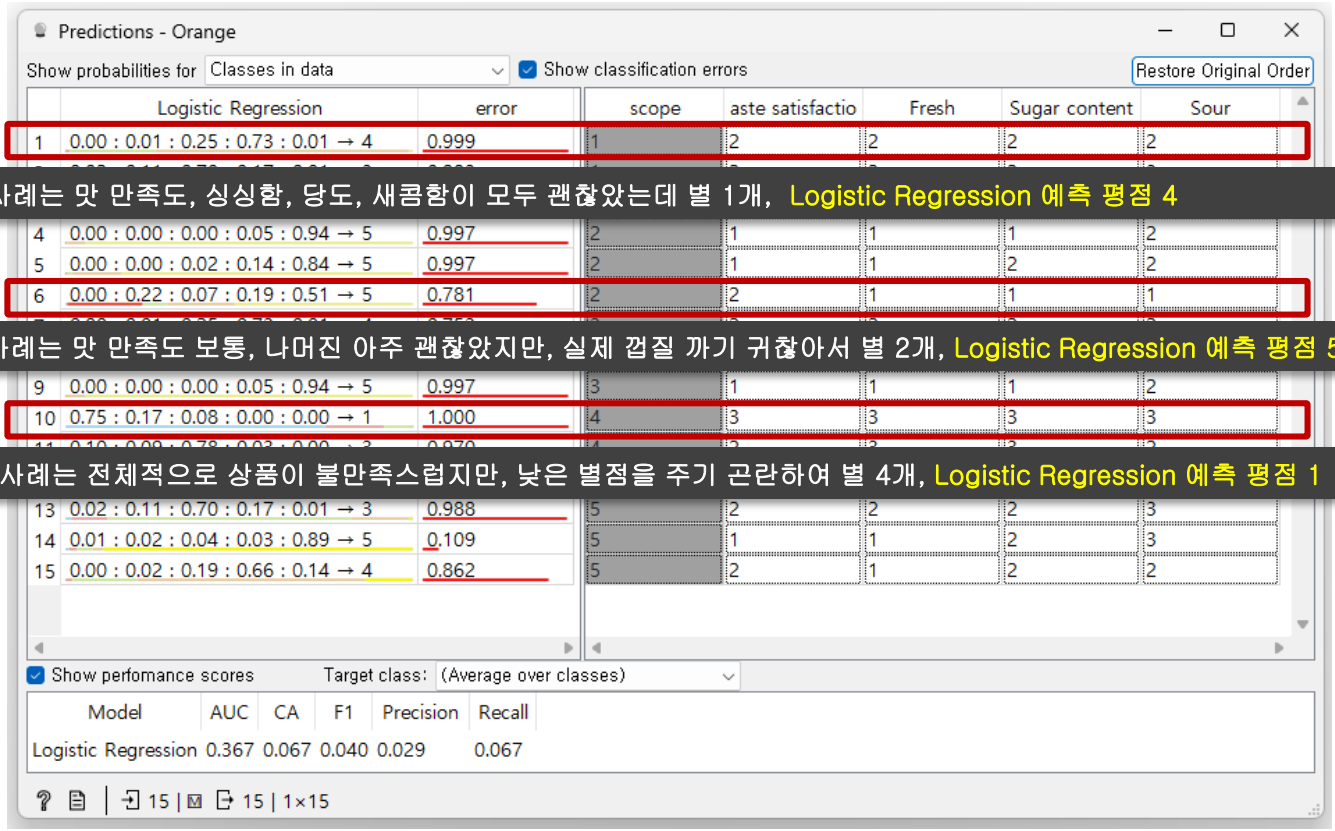
Ex) Star Terror

4 Predictions





4 Predictions



1번 사례는 맛 만족도, 싱싱함, 당도, 새콤함이 모두 괜찮았는데 별 1개, Logistic Regression 예측 평점 4

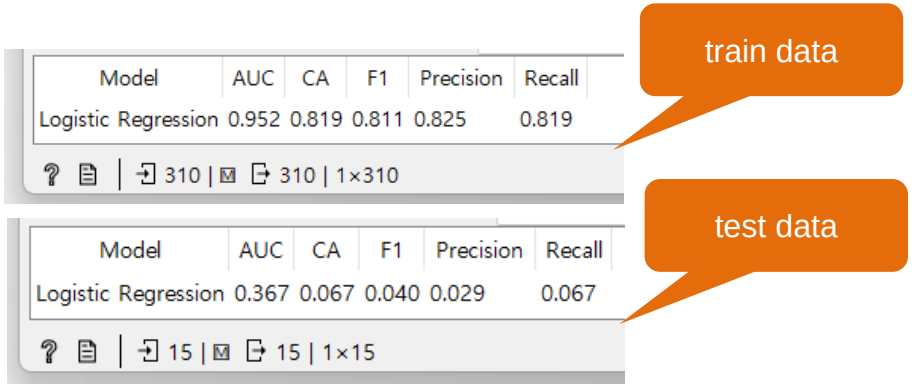
6번 사례는 맛 만족도 보통, 나머진 아주 괜찮았지만, 실제 껍질 까기 귀찮아서 별 2개, Logistic Regression 예측 평점 5

10번 사례는 전체적으로 상품이 불만족스럽지만, 낮은 별점을 주기 곤란하여 별 4개, Logistic Regression 예측 평점 1

딥러닝 모델 평가 지표

Confusion Matrix

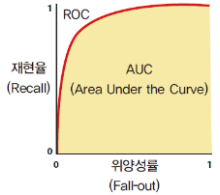
		예측값	
		Positive	Negative
실젯값	True	TP	FN
	False	FP	TN



Positive: 1로 예측, Negative: 0으로 예측

- TP(True Positive): 실젯값이 True인 것을 Positive라고 예측
- TN(True Negative): 실젯값이 False인 것을 Negative라고 예측
- FP(False Positive): 실젯값이 False인 것을 Positive라고 예측
- FN(False Negative): 실젯값이 True인 것을 Negative라고 예측

딥러닝 모델 평가 지표

지표	의미	그래프 또는 식
AUC (Area Under the ROC Curve)	재현율(Recall, 실제 True인 것 중에서 모델이 True라고 분류한 것)과 위양성률(Fall-out, 실제 False인 것 중에서 모델이 True라고 분류한 것의 비율 관계를 나타낸 ROC(Receiver Operating Characteristic) 그래프의 아래쪽 면적	
분류 정확도 (CA)	모델이 입력된 데이터에 대해 얼마나 정확하게 분류하는지를 나타내는 값 (1에 가까울수록 정확도가 높음)	$\frac{TP+TN}{TP+FP+TN+FN}$
정밀도 (Precision)	모델이 True라고 분류한 것 중에서 실제 True인 것의 비율	$\frac{TP}{TP+FP}$
재현율 (Recall)	실제 True인 것 중에서 모델이 True라고 분류한 것의 비율	$\frac{TP}{TP+FN}$
F1	정밀도와 재현율, 두 값의 조화 평균으로 하나의 수치로 나타낸 지표	

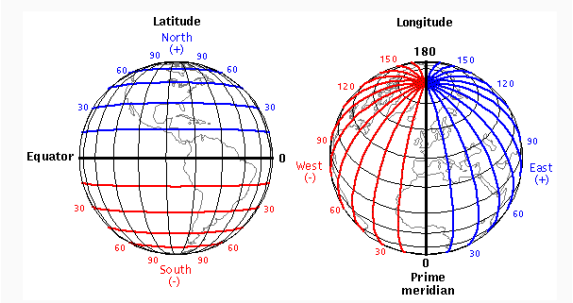
Conclusion

- 맛 만족도, 싱싱함, 당도, 새콤함 등의 변수가 모두 좋더라도 별 개수가 작게 나올 수 있음이 분석되었음
- 사용자의 별 평가 개수가 전체적인 맛 평가와 유사하다고 할 수 없음
- Logistic Regression은 맛 만족도, 싱싱함, 당도, 새콤함 등의 변수를 기반으로 **전체적인 맛 평가 결과를 신뢰할 수 있게 예측**함

3. Courier delivery location clustering using k-Means

Problem

- 주소지 중심으로 택배를 분류하면, 인근 거리임에도 행정 구역상 주소지가 다를 경우 택배 배달원의 배달 업무가 비효율적으로 수행될 수 있음
- AI가 택배 배달원의 효율적인 배달 업무를 위해서 주소지 중심으로 택배를 분류하지 않고, 인근 거리 위주로 택배 배달 물품을 분류할 수 있을까?

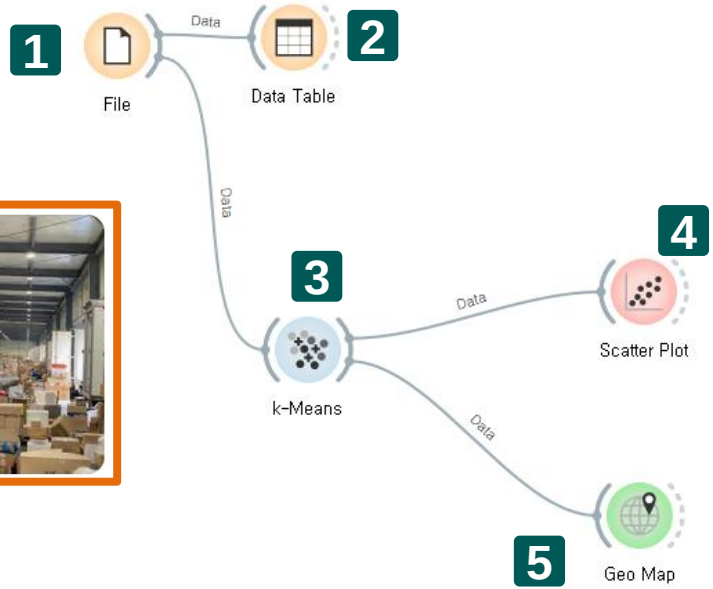


Data Type

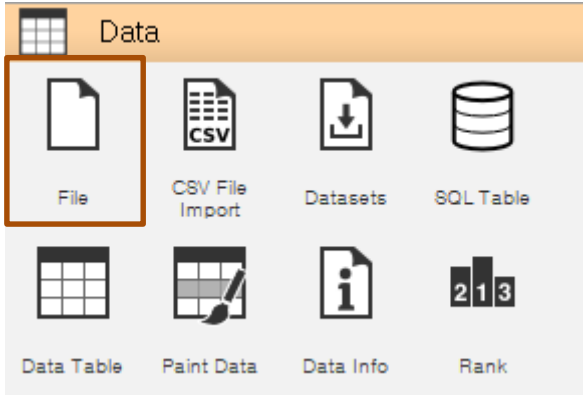
Structured data

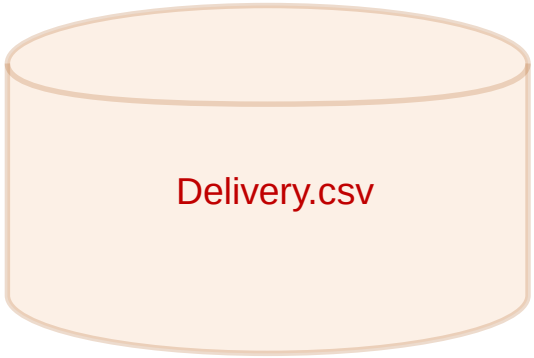
AI Model

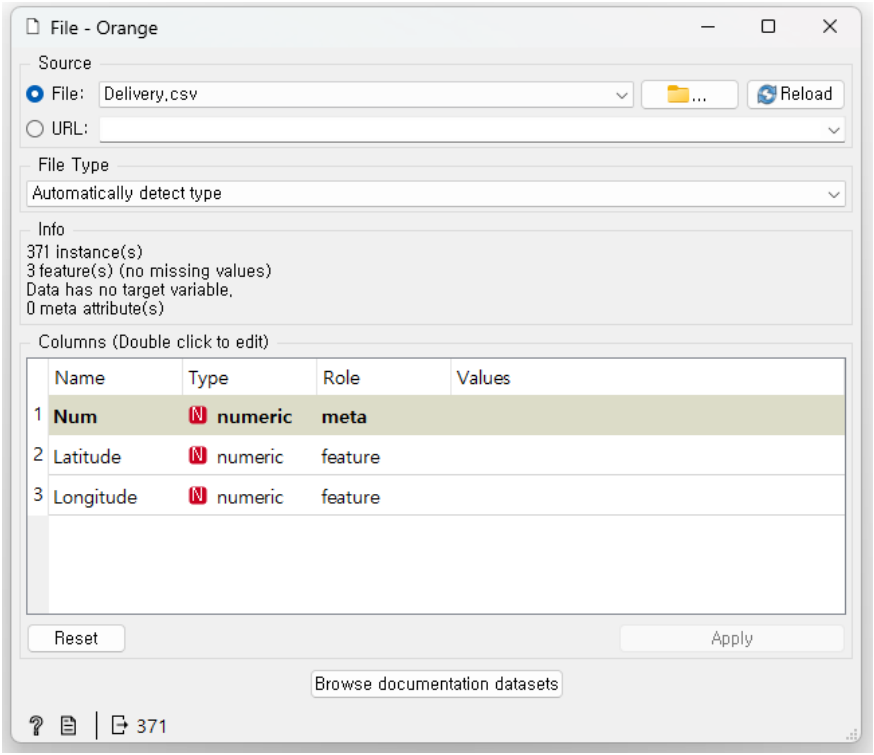
K-Means



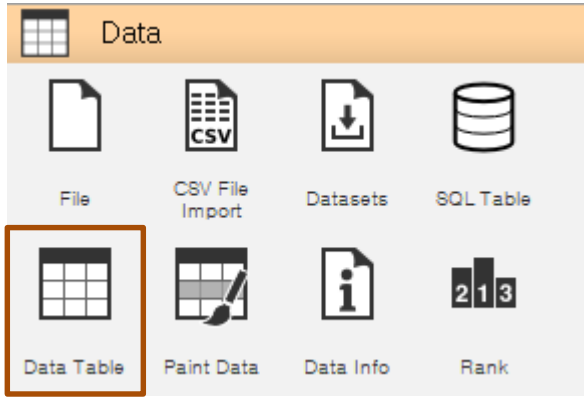
1 File

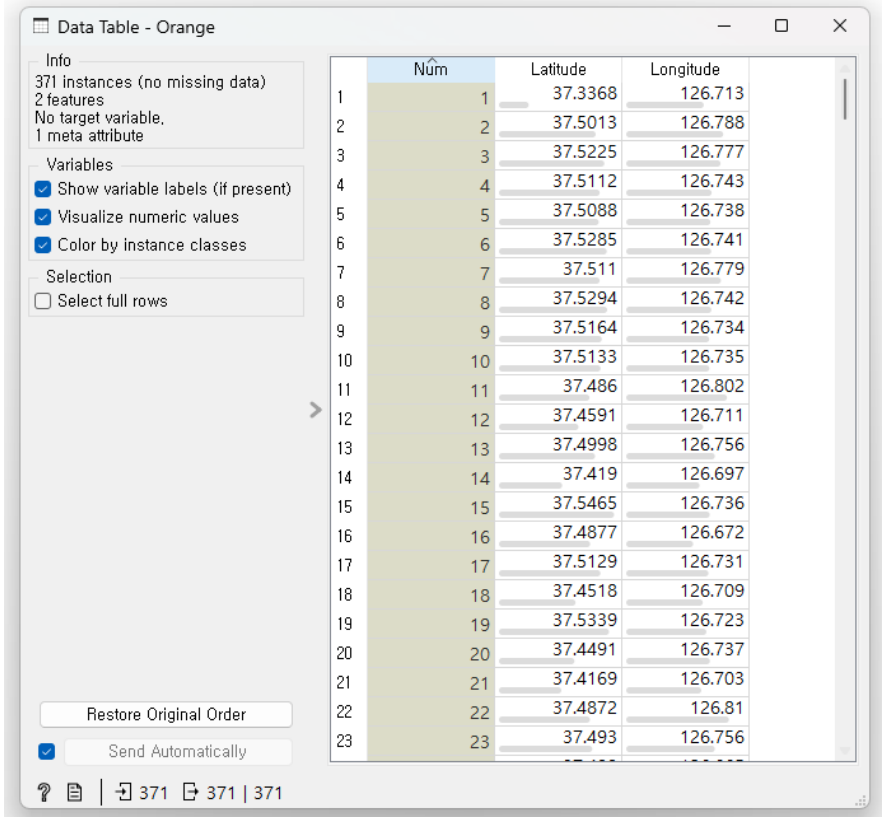






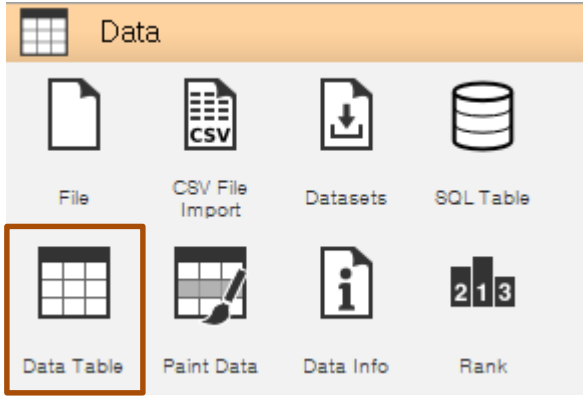
2 Data Table





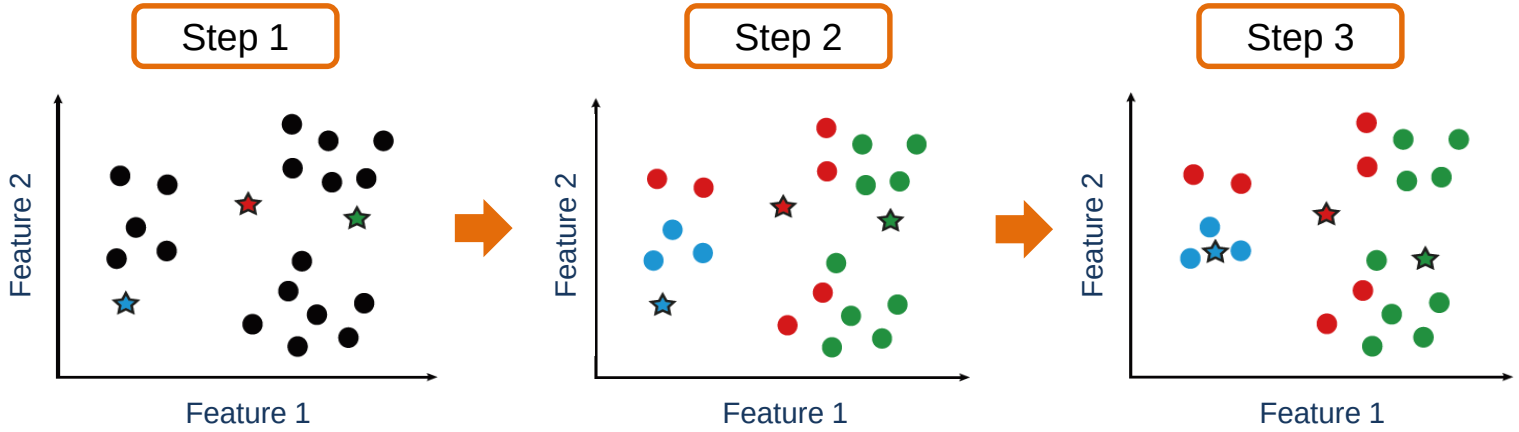
	Num	Latitude	Longitude
1	1	37.3368	126.713
2	2	37.5013	126.788
3	3	37.5225	126.777
4	4	37.5112	126.743
5	5	37.5088	126.738
6	6	37.5285	126.741
7	7	37.511	126.779
8	8	37.5294	126.742
9	9	37.5164	126.734
10	10	37.5133	126.735
11	11	37.486	126.802
12	12	37.4591	126.711
13	13	37.4998	126.756
14	14	37.419	126.697
15	15	37.5465	126.736
16	16	37.4877	126.672
17	17	37.5129	126.731
18	18	37.4518	126.709
19	19	37.5339	126.723
20	20	37.4491	126.737
21	21	37.4169	126.703
22	22	37.4872	126.81
23	23	37.493	126.756

2 Data Table



Attribute name	Attribute
Num	일련번호
Latitude	위도
Longitude	경도

Clustering process of k-Means

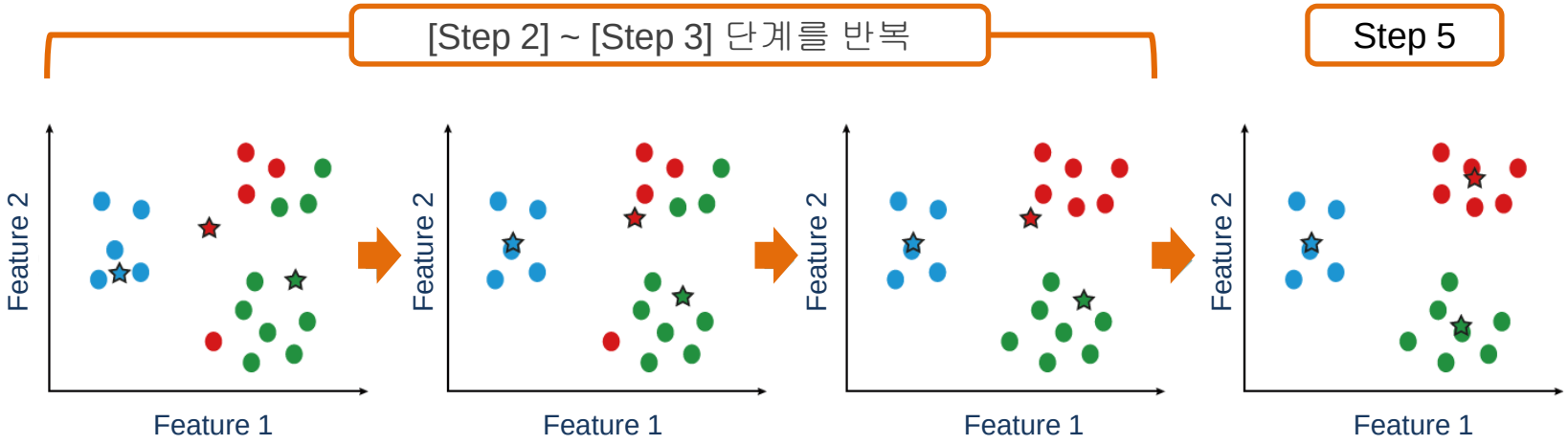


데이터 셋에서 k개의
중심을 임의로 지정

중심으로부터 모든 데이터가
얼마나 떨어져 있는지 계산한 후,
각 데이터에서 가장 가까운 중심 지정

[Step 2]에서 출력된 결과를
기반으로 중심을 새롭게 지정

Clustering process of k-Means



[Step 2]

중심으로부터 모든 데이터가 얼마나 떨어져 있는지 계산한 후, 각 데이터에서 가장 가까운 중심 지정

[Step 3]

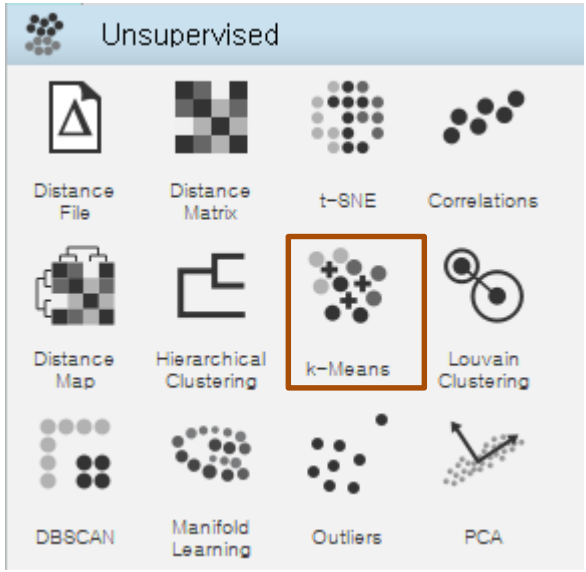
[Step 2]에서 출력된 결과를 기반으로 중심을 새롭게 지정

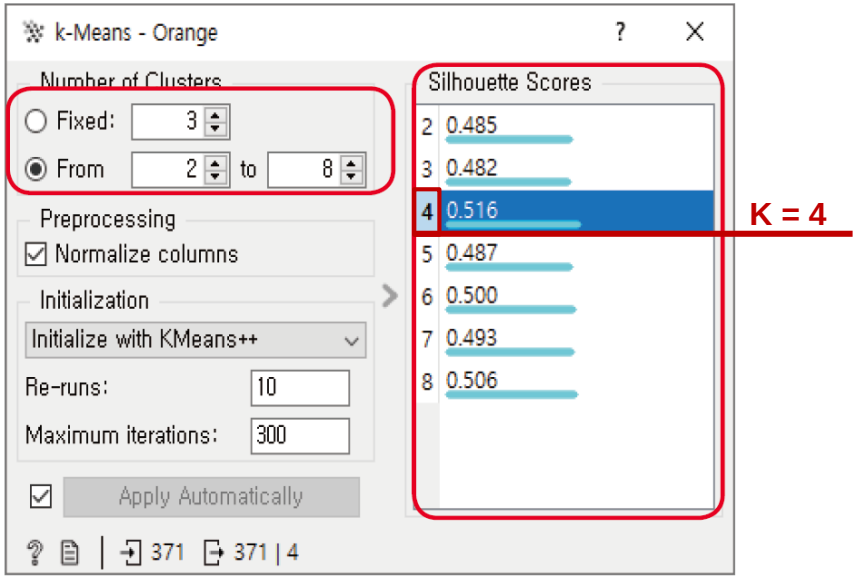
[Step 2]

중심으로부터 모든 데이터가 얼마나 떨어져 있는지 계산한 후, 각 데이터에서 가장 가까운 중심 지정

중심이 더 이상 변하지 않으면 반복 종료

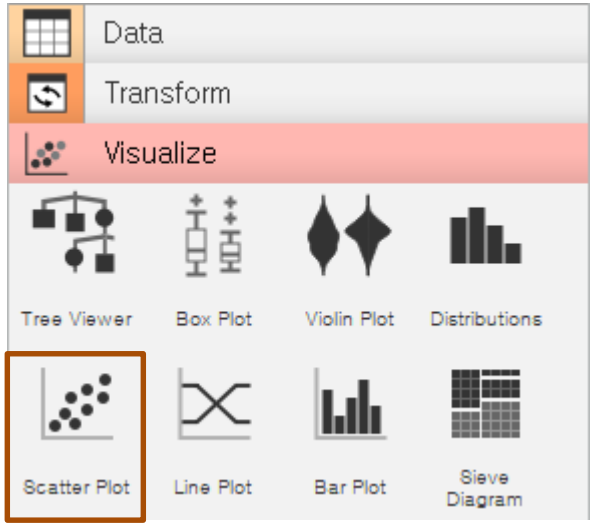
3 K-Means

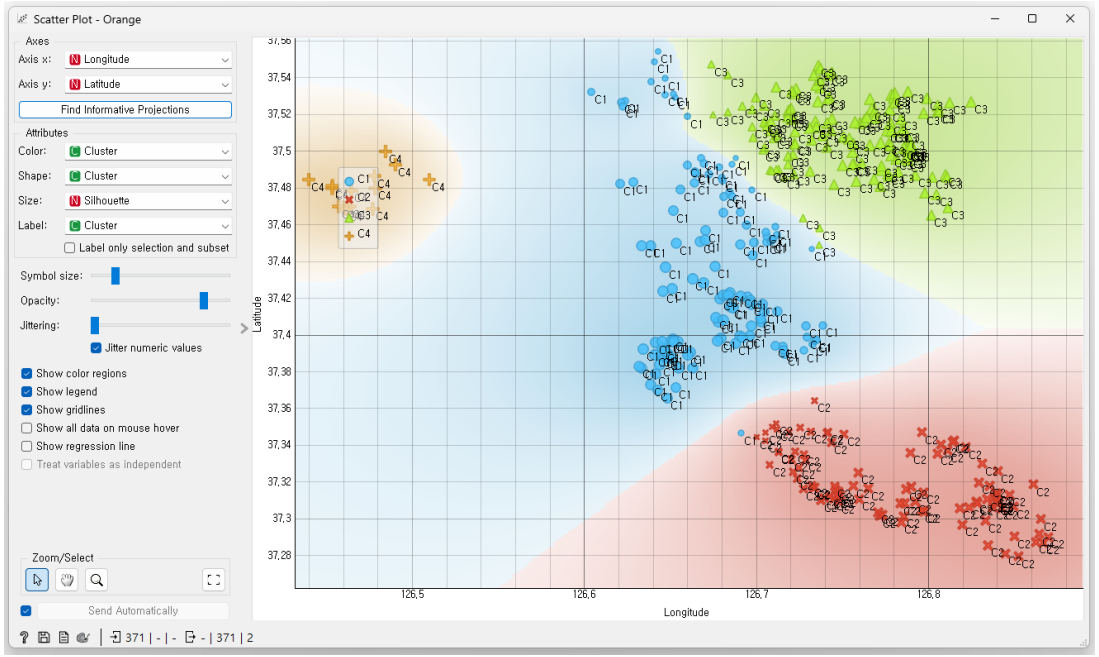




- **Number of Clusters**
  - Fixed: 원하는 cluster의 개수를 설정
  - From: Silhouette Scores를 보여 주는 범위를 설정
    [Silhouette Scores] 해당 범위 내에서 가장 높은 점수의 cluster 개수를 추천

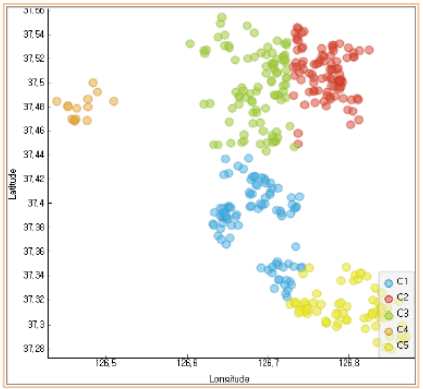
4 Scatter Plot



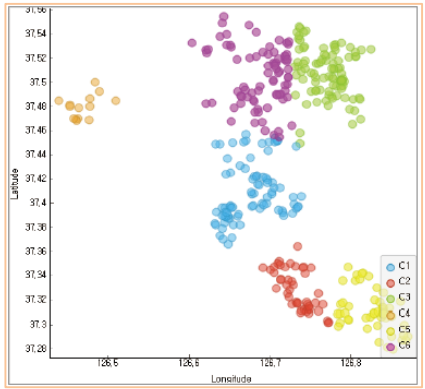


4 Scatter Plot

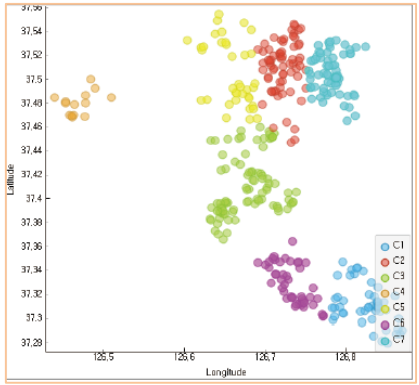
[K=5]



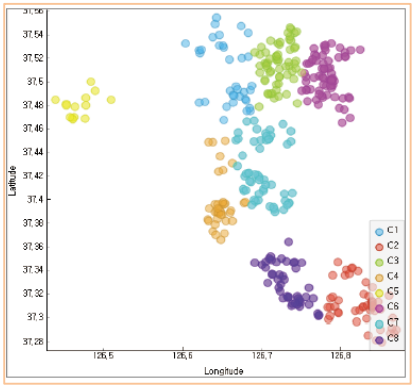
[K=6]



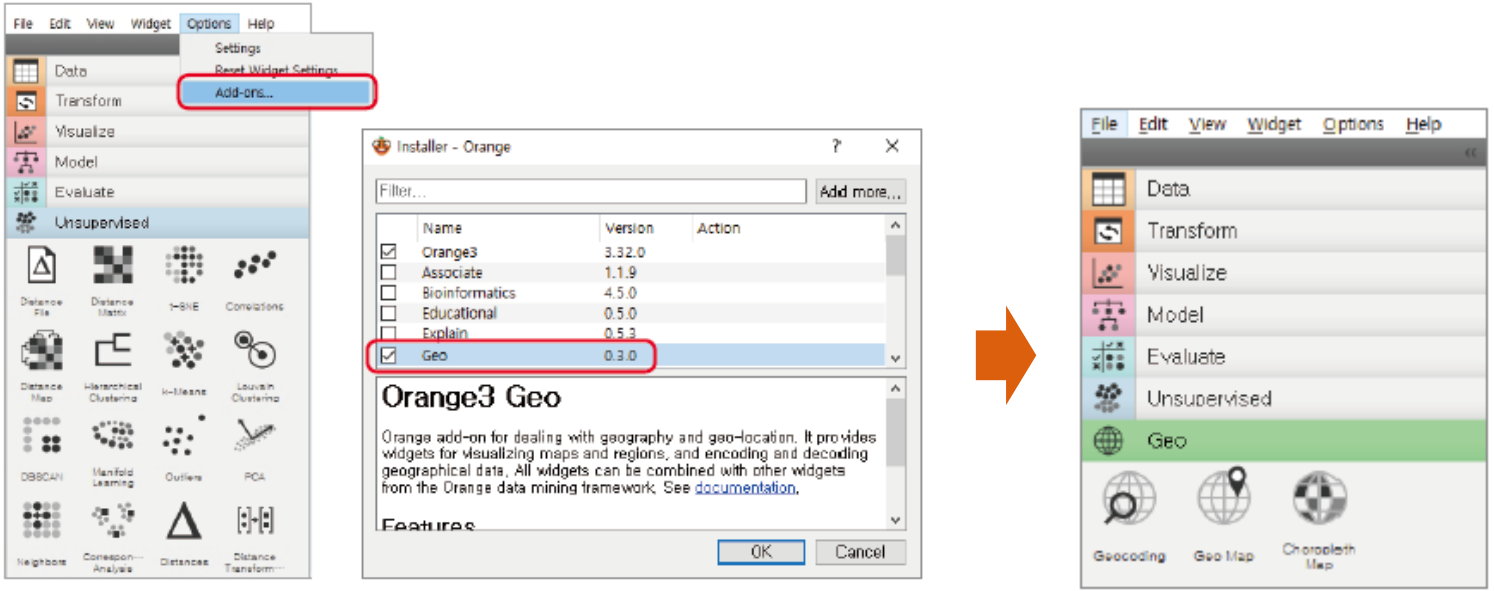
[K=7]



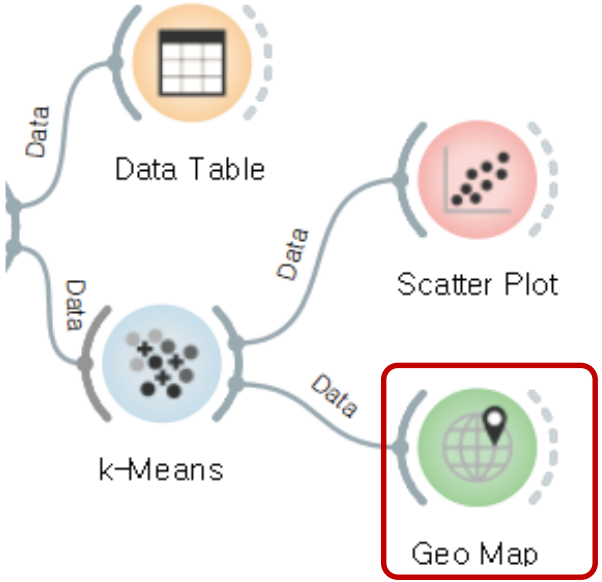
[K=8]



5 Geo Map

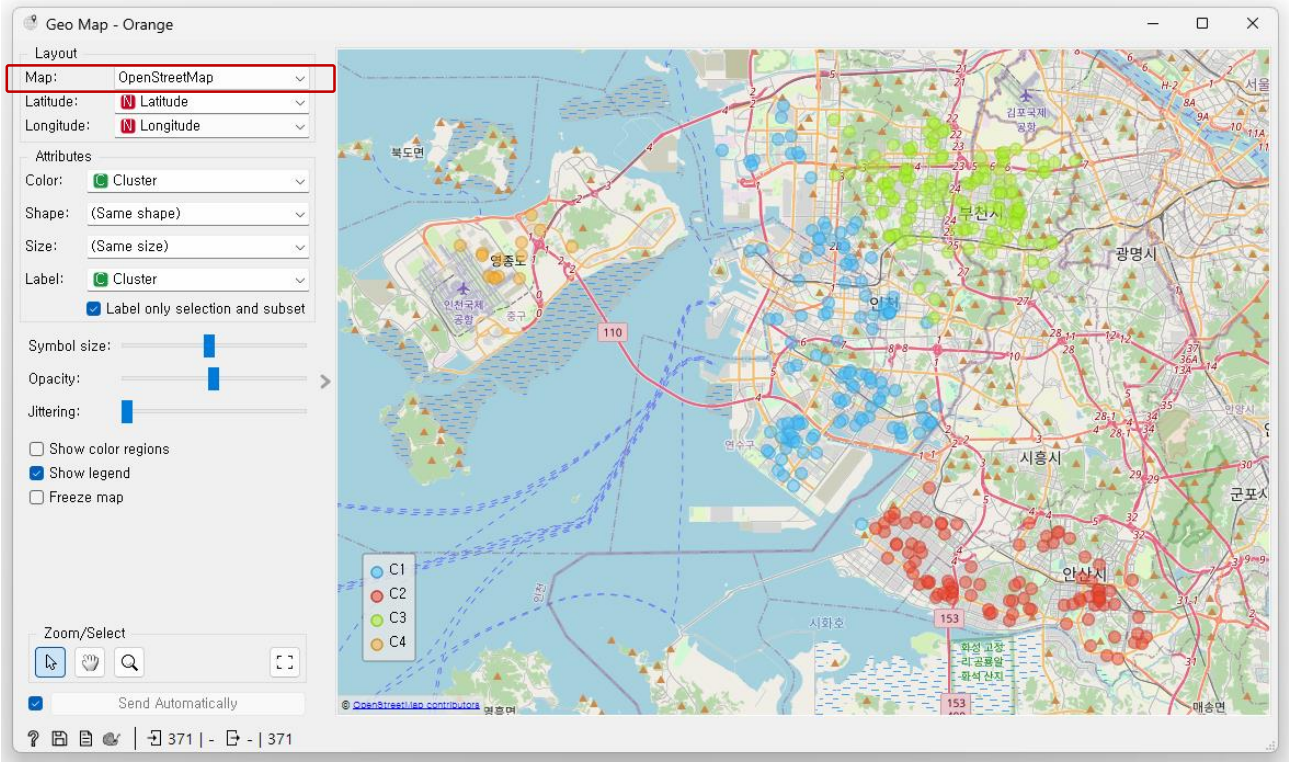


5 Geo Map



5 Geo Map

- Map
  - OpenStreetMap
  - Black and white
  - Topographic
  - Satellite
  - Print
  - Dark



Conclusion

- 인천광역시, 안산시 등의 행정 구역 기반의 택배 거점을 클러스터 기반으로 변경한다면, 비용을 절약할 뿐만 아니라 택배 집하장 선정 등을 최적화할 수 있을 것으로 기대함

1-Hour Group Project


Thank you
광주과학기술원
AI대학원