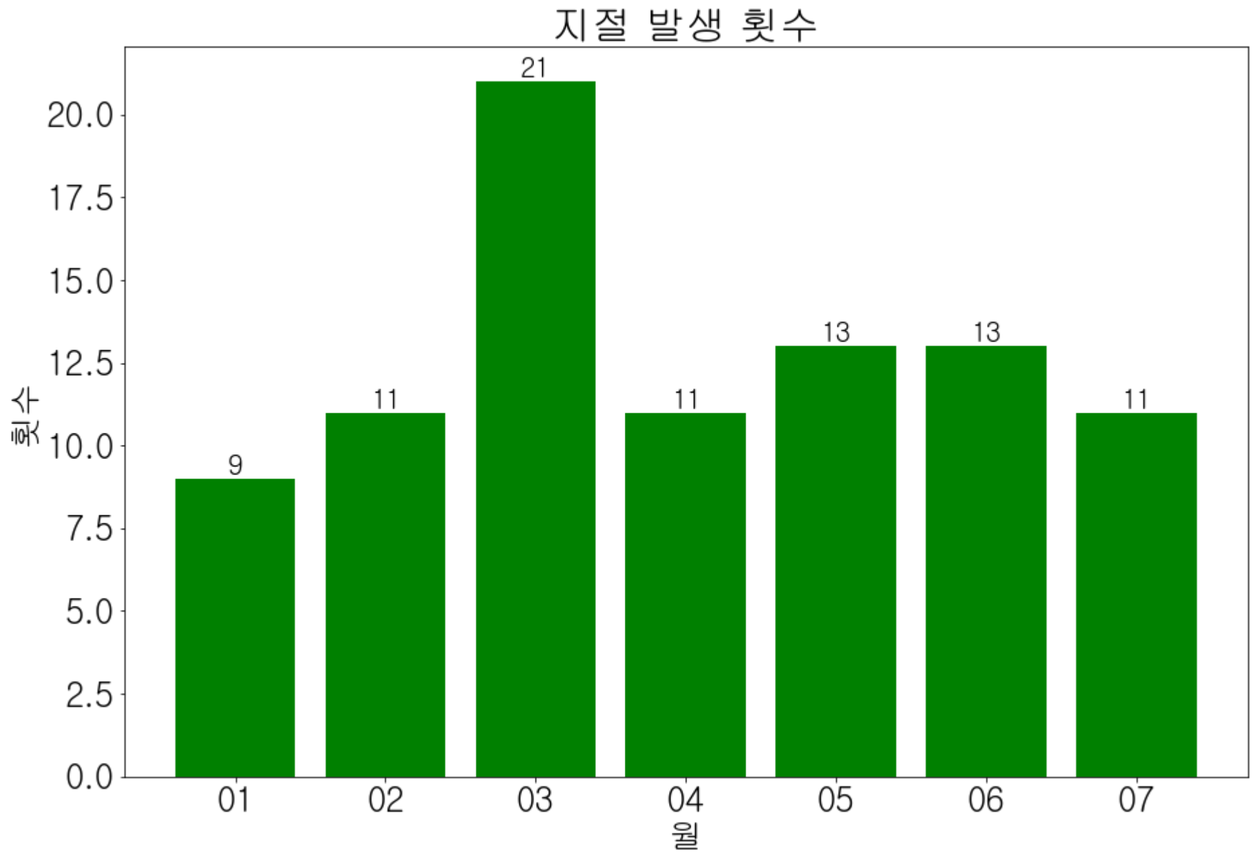
01월 13일 과제 발표

공정 시스템 에너지 절감을 위한 SVM과 t-SNE을 이용한 제지 데이터 분류

이 관 영

1.데이터 전처리


지절 발생 횟수
횟수
월
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
9
11
21
11
13
13
11
01
02
03
04
05
06
07

1.데이터 전처리

	작업시작시간	지절
0	2022-03-05 19:24:00	1
1	2022-03-07 01:52:00	1
2	2022-03-07 02:12:00	1
3	2022-03-07 04:16:00	1
4	2022-03-09 21:30:00	1
5	2022-03-09 21:40:00	1
6	2022-03-10 20:00:00	1
7	2022-03-10 20:24:00	1
8	2022-03-11 01:37:00	1
9	2022-03-11 04:25:00	1
10	2022-03-11 05:17:00	1
11	2022-03-12 05:16:00	1
12	2022-03-12 05:31:00	1
13	2022-03-12 06:36:00	1
14	2022-03-12 06:41:00	1
15	2022-03-13 18:04:00	1
16	2022-03-13 18:36:00	1
17	2022-03-13 21:13:00	1
18	2022-03-13 21:59:00	1
19	2022-03-14 02:37:00	1
20	2022-03-18 17:05:00	1

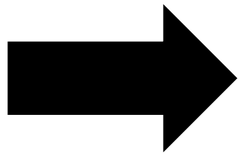
MES
- 작업시작시간, 지종, 평량, 지절 유무

DCS/QCS
- Sensor values

Power
- 공정에서 사용한 전력 에너지

1.데이터 전처리

	329-GZC9969:av
2022-03-01 00:00:00	39692.2
2022-03-01 00:00:01	39692.2
2022-03-01 00:00:02	NaN
2022-03-01 00:00:03	39725.6
2022-03-01 00:00:04	NaN
2022-03-01 00:00:05	NaN
2022-03-01 00:00:06	39775.8
2022-03-01 00:00:07	39792.6
2022-03-01 00:00:08	NaN
2022-03-01 00:00:09	NaN
2022-03-01 00:00:10	39842.8
2022-03-01 00:00:11	NaN
2022-03-01 00:00:12	39876.3
2022-03-01 00:00:13	39876.3
2022-03-01 00:00:14	NaN
2022-03-01 00:00:15	NaN
2022-03-01 00:00:16	NaN
2022-03-01 00:00:17	NaN
2022-03-01 00:00:18	NaN
2022-03-01 00:00:19	NaN



	329-GZC9969:av
2022-03-01 00:00:00	39692.200000
2022-03-01 00:00:01	39692.200000
2022-03-01 00:00:02	39708.900000
2022-03-01 00:00:03	39725.600000
2022-03-01 00:00:04	39742.333333
2022-03-01 00:00:05	39759.066667
2022-03-01 00:00:06	39775.800000
2022-03-01 00:00:07	39792.600000
2022-03-01 00:00:08	39809.333333
2022-03-01 00:00:09	39826.066667
2022-03-01 00:00:10	39842.800000
2022-03-01 00:00:11	39859.550000
2022-03-01 00:00:12	39876.300000
2022-03-01 00:00:13	39876.300000
2022-03-01 00:00:14	39876.300000
2022-03-01 00:00:15	39876.300000
2022-03-01 00:00:16	39876.300000
2022-03-01 00:00:17	39876.300000
2022-03-01 00:00:18	39876.300000
2022-03-01 00:00:19	39876.300000

2.스피어만 상관 계수

	Corr	P-val	Corr_abs
지종	-0.111548	0.001101	0.111548
HFEMS.MRPAP.01.SH01.PL003.04.PF	-0.108407	0.001520	0.108407
HFEMS.MRPAP.01.SH01.PL003.03.VA	0.102661	0.002683	0.102661
320PIC7513:me	0.101311	0.003055	0.101311
PM3-S5SC.opr:me	0.100617	0.003263	0.100617
HFEMS.MRPAP.01.SH01.PL003.03.KW	0.099899	0.003493	0.099899
HFEMS.MRPAP.01.SH01.PL003.02.PF	-0.099835	0.003514	0.099835
320PIC7544:me	0.099337	0.003682	0.099337
HFEMS.MRPAP.01.SH01.PL003.03.A_T	0.098862	0.003850	0.098862
320PIC7508:me	-0.095678	0.005163	0.095678
320PDC7516:me	0.095290	0.005348	0.095290
320PIC7505:me	-0.092373	0.006941	0.092373
HFEMS.MRPAP.01.SH01.PL003.03.VAR	0.077378	0.023822	0.077378
HFEMS.MRPAP.01.SH01.PL003.03.A_S	0.074490	0.029600	0.074490
320PIC7514:me	0.074195	0.030253	0.074195
320PDC7520:me	-0.073109	0.032763	0.073109
HFEMS.MRPAP.01.SH01.PL003.02.KW	0.071375	0.037143	0.071375
320PIC7509:me	-0.069676	0.041906	0.069676
PM3_ASH_PV	0.067169	0.049869	0.067169

	지종	횟수
1	네오★백상(100)	80
2	네오★스노우화이트기지(73)	53
3	네오★스노우화이트기지(77)	39
4	네오★스노우화이트기지(62)	26
5	네오★아트 R10기지(77)	22
6	네오★라벨기지(67)	11
7	네오★스노우화이트R10기(67)	1
8	네오★아트기지(62)	1
9	네오★아트기지(73)	1

2.스피어만 상관 계수

	Corr	P-val	Corr_abs
지종	-0.111548	0.001101	0.111548
HFEMS.MRPAP.01.SH01.PL003.04.PF	-0.108407	0.001520	0.108407
HFEMS.MRPAP.01.SH01.PL003.03.VA	0.102661	0.002683	0.102661
320PIC7513:me	0.101311	0.003055	0.101311
PM3-S5SC.opr:me	0.100617	0.003263	0.100617
HFEMS.MRPAP.01.SH01.PL003.03.KW	0.099899	0.003493	0.099899
HFEMS.MRPAP.01.SH01.PL003.02.PF	-0.099835	0.003514	0.099835
320PIC7544:me	0.099337	0.003682	0.099337
HFEMS.MRPAP.01.SH01.PL003.03.A_T	0.098862	0.003850	0.098862
320PIC7508:me	-0.095678	0.005163	0.095678
320PDC7516:me	0.095290	0.005348	0.095290
320PIC7505:me	-0.092373	0.006941	0.092373
HFEMS.MRPAP.01.SH01.PL003.03.VAR	0.077378	0.023822	0.077378
HFEMS.MRPAP.01.SH01.PL003.03.A_S	0.074490	0.029600	0.074490
320PIC7514:me	0.074195	0.030253	0.074195
320PDC7520:me	-0.073109	0.032763	0.073109
HFEMS.MRPAP.01.SH01.PL003.02.KW	0.071375	0.037143	0.071375
320PIC7509:me	-0.069676	0.041906	0.069676
PM3_ASH_PV	0.067169	0.049869	0.067169

Sensor

320PIC7513:me	4nd pre-dry group
PM3-S5SC.opr:me	5G steam pressure
320PIC7544:me	Steam box pressure
320PIC7508:me	3rd dry cylinder
320PDC7516:me	1st dry group
320PIC7505:me	1st dry cylinder pressure
320PIC7514:me	5th bottom dry group
320PDC7520:me	4th dry group
320PIC7509:me	1st dry group
PM3_ASH_PV	회분량

2.스피어만 상관 계수

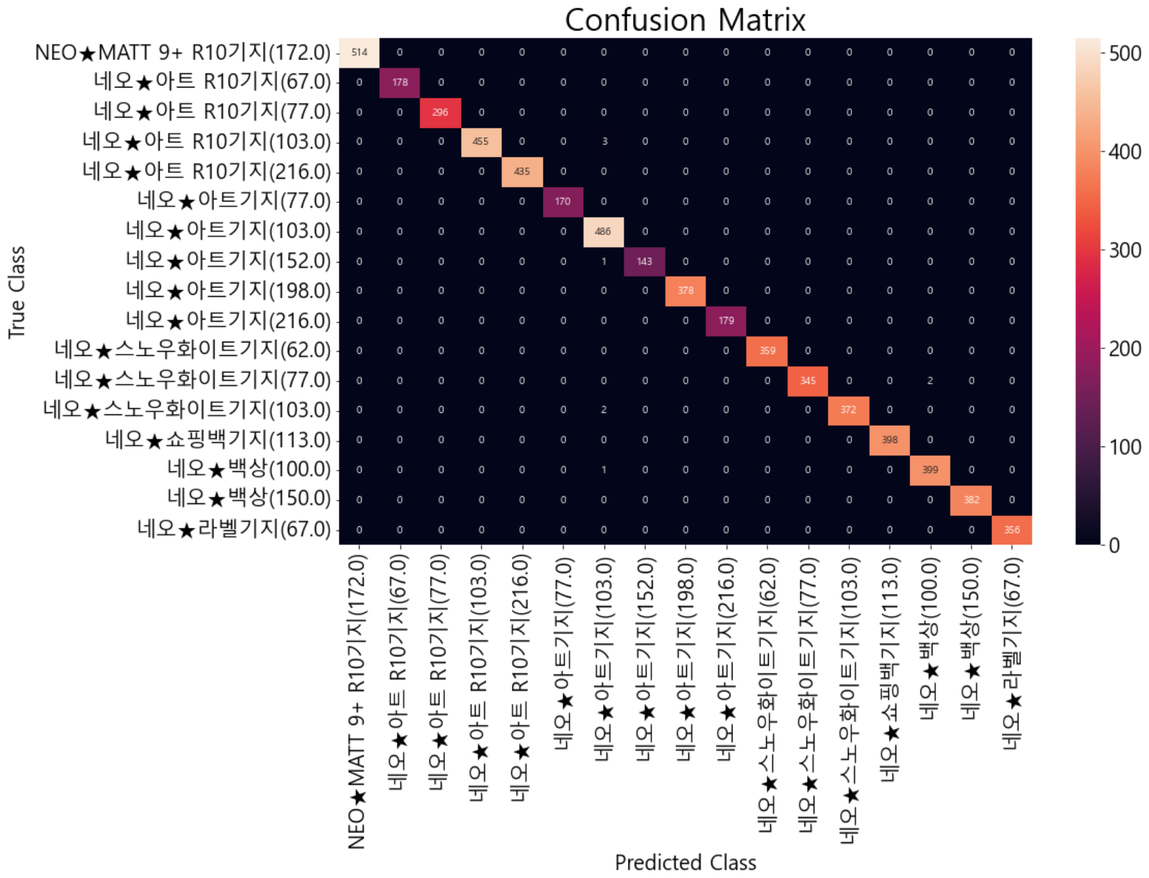
	Corr	P-val	Corr_abs
지종	-0.111548	0.001101	0.111548
HFEMS.MRPAP.01.SH01.PL003.04.PF	-0.108407	0.001520	0.108407
HFEMS.MRPAP.01.SH01.PL003.03.VA	0.102661	0.002683	0.102661
320PIC7513:me	0.101311	0.003055	0.101311
PM3-S5SC.opr:me	0.100617	0.003263	0.100617
HFEMS.MRPAP.01.SH01.PL003.03.KW	0.099899	0.003493	0.099899
HFEMS.MRPAP.01.SH01.PL003.02.PF	-0.099835	0.003514	0.099835
320PIC7544:me	0.099337	0.003682	0.099337
HFEMS.MRPAP.01.SH01.PL003.03.A_T	0.098862	0.003850	0.098862
320PIC7508:me	-0.095678	0.005163	0.095678
320PDC7516:me	0.095290	0.005348	0.095290
320PIC7505:me	-0.092373	0.006941	0.092373
HFEMS.MRPAP.01.SH01.PL003.03.VAR	0.077378	0.023822	0.077378
HFEMS.MRPAP.01.SH01.PL003.03.A_S	0.074490	0.029600	0.074490
320PIC7514:me	0.074195	0.030253	0.074195
320PDC7520:me	-0.073109	0.032763	0.073109
HFEMS.MRPAP.01.SH01.PL003.02.KW	0.071375	0.037143	0.071375
320PIC7509:me	-0.069676	0.041906	0.069676
PM3_ASH_PV	0.067169	0.049869	0.067169

Power

HFEMS.MRPAP.01.SH01.PL003.04.PF	DRIVE #1,2 역률
HFEMS.MRPAP.01.SH01.PL003.03.VA	초지저압 2 피상전력
HFEMS.MRPAP.01.SH01.PL003.03.KW	초지저압 2 유효전력
HFEMS.MRPAP.01.SH01.PL003.02.PF	초지저압 1,3 CONTROL역률
HFEMS.MRPAP.01.SH01.PL003.03.A_T	초지저압 2 전류_T
HFEMS.MRPAP.01.SH01.PL003.03.VAR	초지저압 2 무효전력
HFEMS.MRPAP.01.SH01.PL003.03.A_S	초지저압 2 전류_S
HFEMS.MRPAP.01.SH01.PL003.02.KW	초지저압 1,3 CONTROL 유효전력

3.SVM 모델링 분류

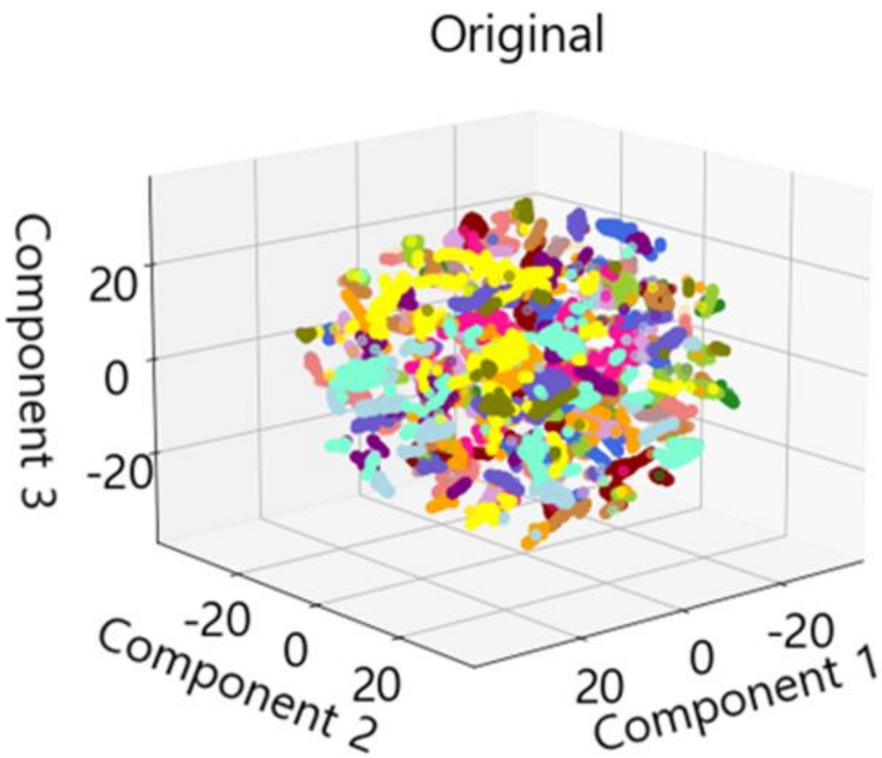
03

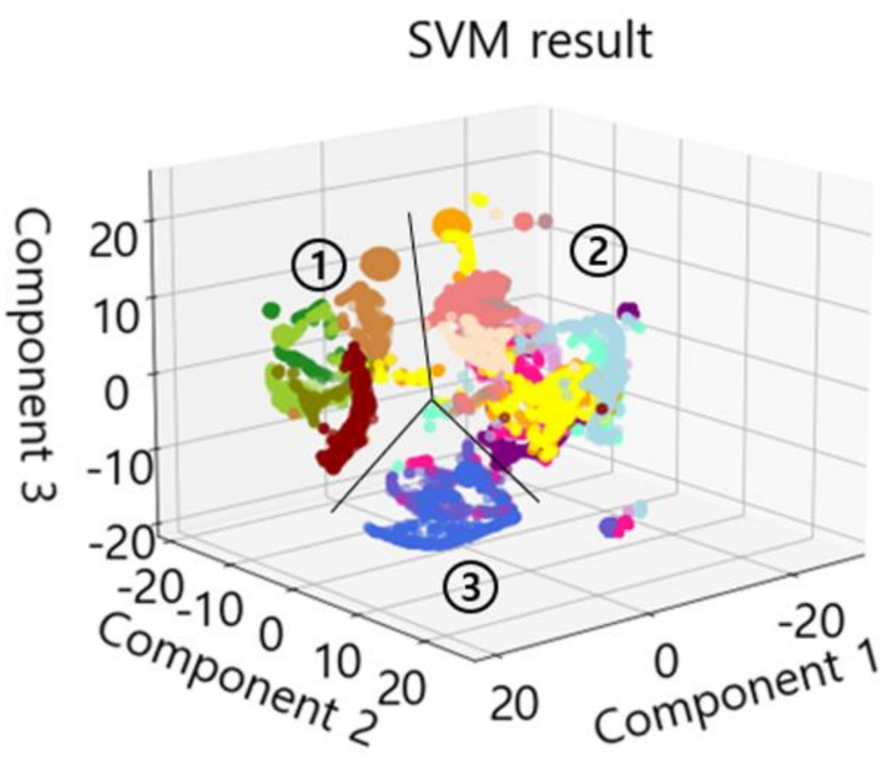


MES	Sensor	Power
지종	320PIC7513:me	HFEMS.MRPAP.01.SH01.PL003.04.PF
평량	PM3-S5SC.opr:me	HFEMS.MRPAP.01.SH01.PL003.03.VA
지절 유무	320PIC7544:me	HFEMS.MRPAP.01.SH01.PL003.03.KW
	320PIC7508:me	HFEMS.MRPAP.01.SH01.PL003.02.PF
	320PDC7516:me	HFEMS.MRPAP.01.SH01.PL003.03.A_T
	320PIC7505:me	HFEMS.MRPAP.01.SH01.PL003.03.VAR
	320PIC7514:me	HFEMS.MRPAP.01.SH01.PL003.03.A_S
	320PDC7520:me	HFEMS.MRPAP.01.SH01.PL003.02.KW
	320PIC7509:me	
	PM3_ASH_PV	

Accuracy(정확도) ≒ 0.98

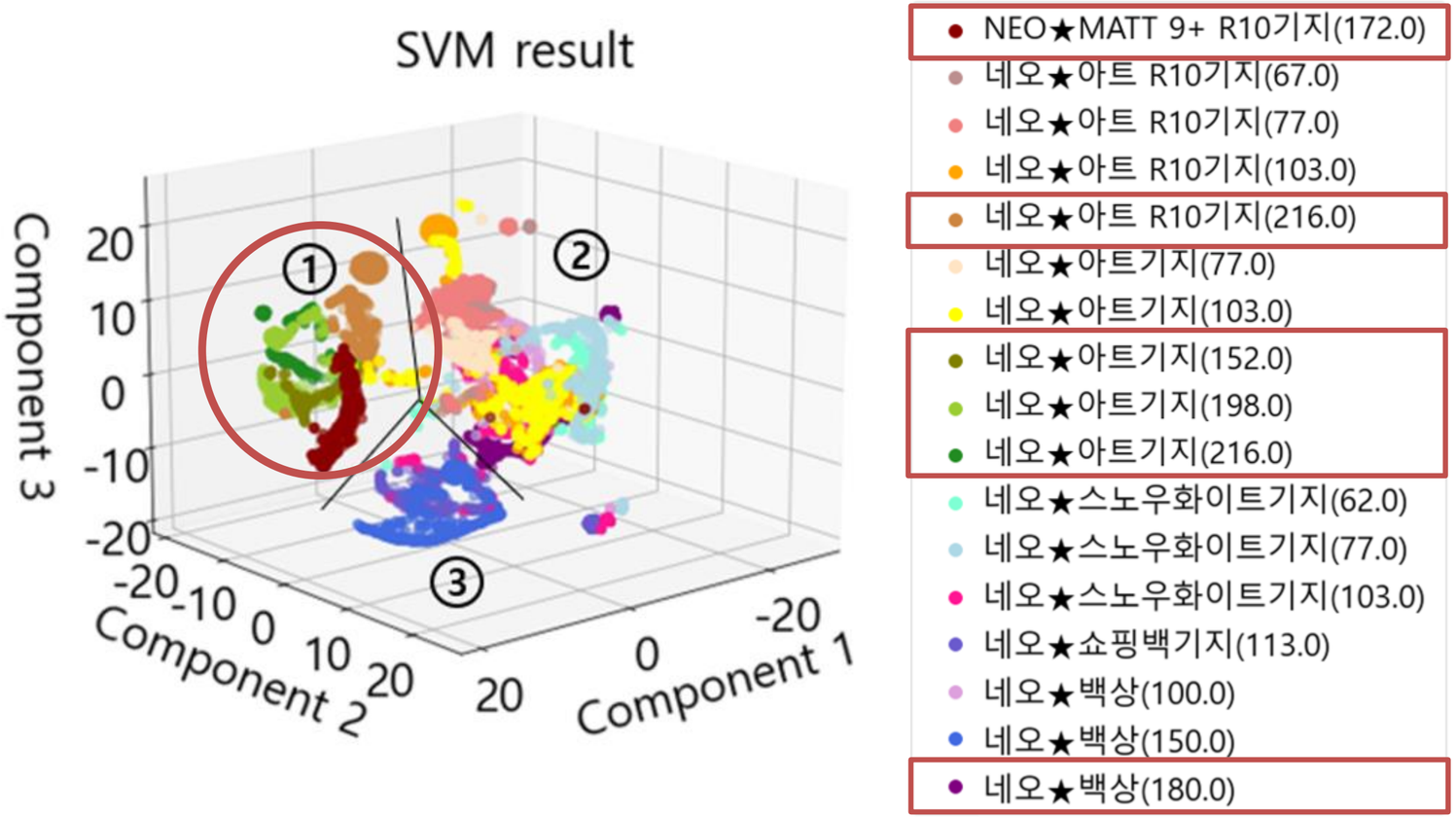
4.t-SNE





- NEO★MATT 9+ R10기지(172.0)
- 네오★아트 R10기지(67.0)
- 네오★아트 R10기지(77.0)
- 네오★아트 R10기지(103.0)
- 네오★아트 R10기지(216.0)
- 네오★아트기지(77.0)
- 네오★아트기지(103.0)
- 네오★아트기지(152.0)
- 네오★아트기지(198.0)
- 네오★아트기지(216.0)
- 네오★스노우화이트기지(62.0)
- 네오★스노우화이트기지(77.0)
- 네오★스노우화이트기지(103.0)
- 네오★쇼핑백기지(113.0)
- 네오★백상(100.0)
- 네오★백상(150.0)
- 네오★백상(180.0)

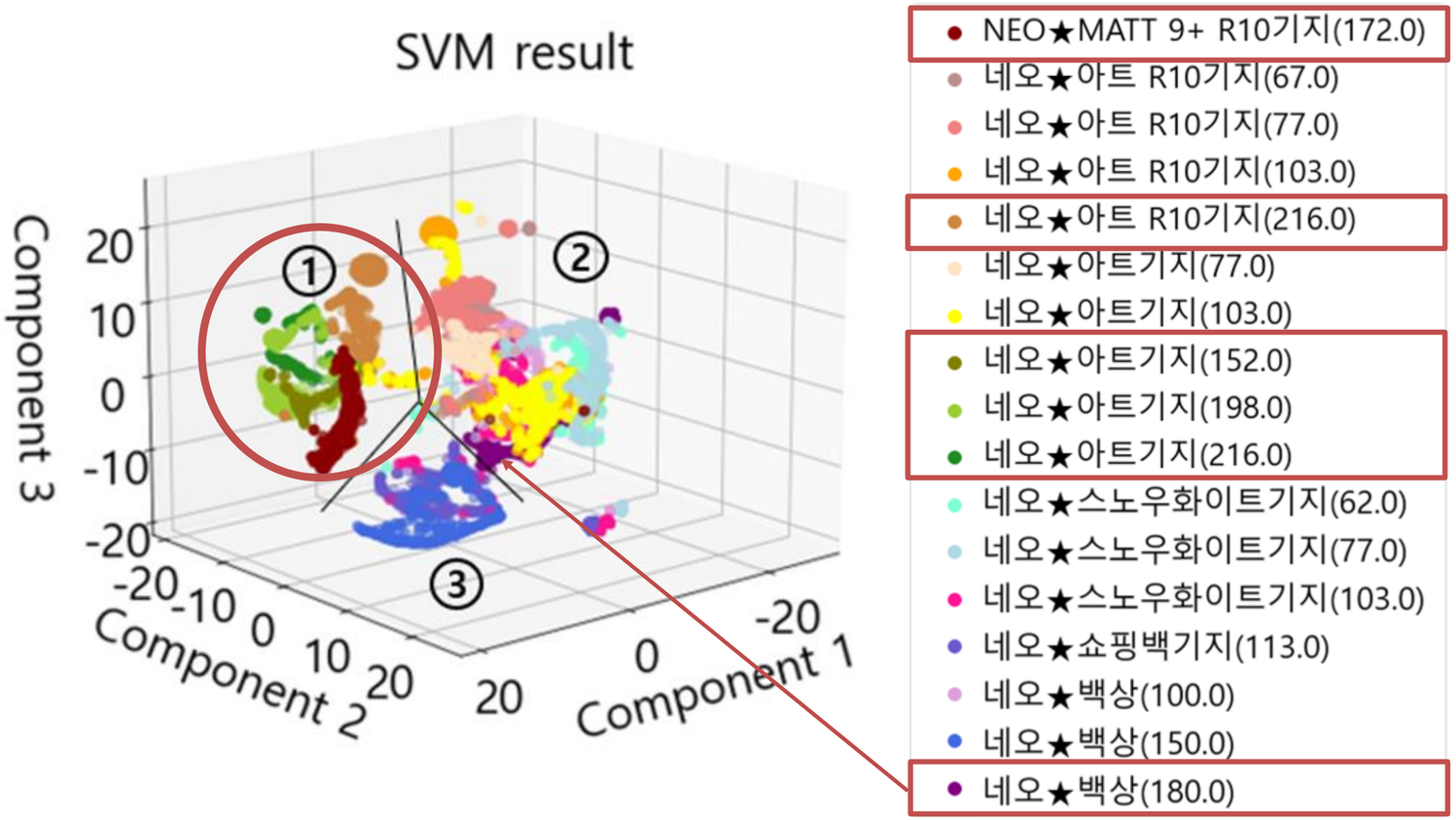
4.t-SNE



고평량

-216
-198
-180
-172
-152

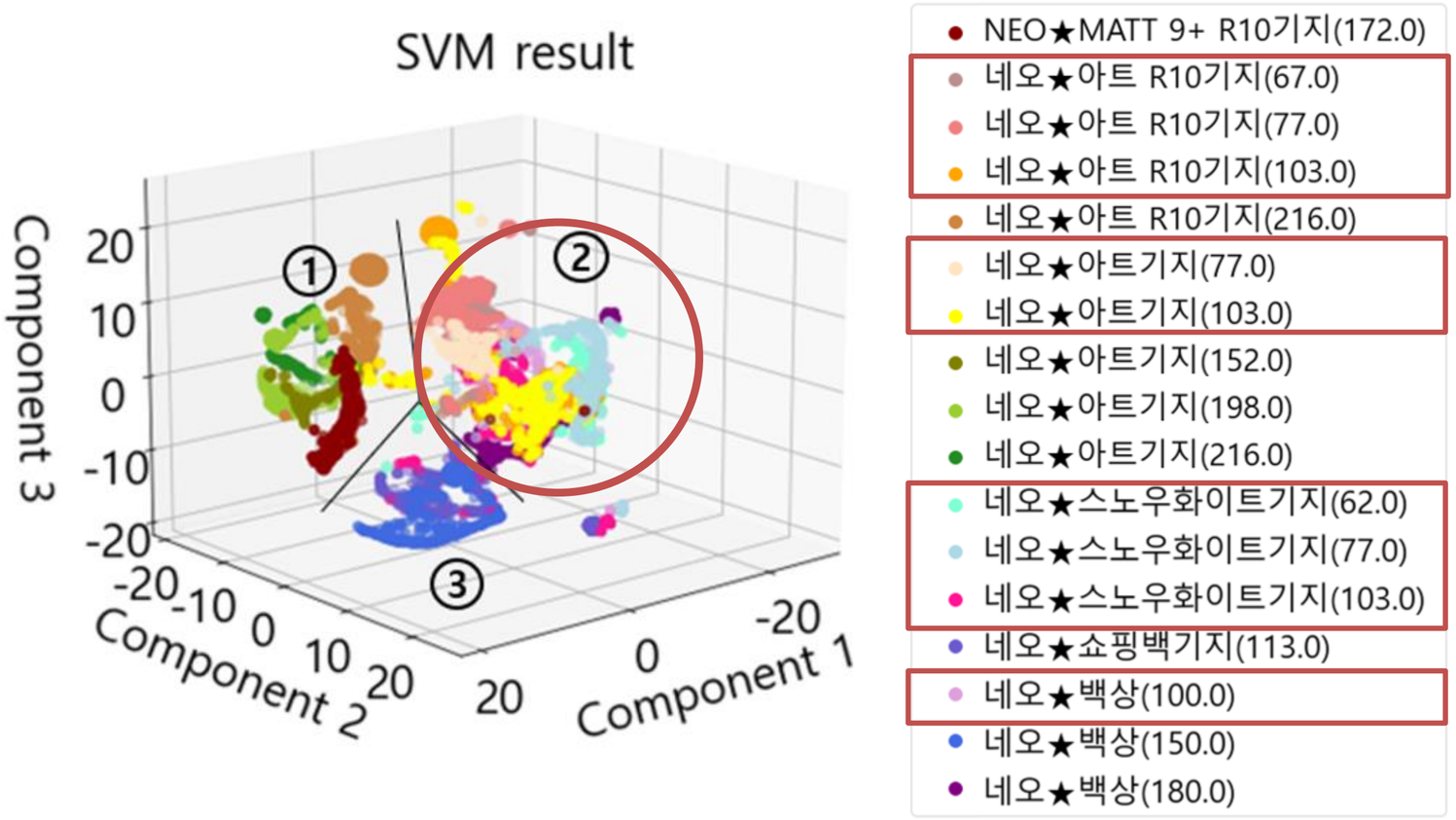
4.t-SNE



고평량

-216
-198
-180
-172
-152

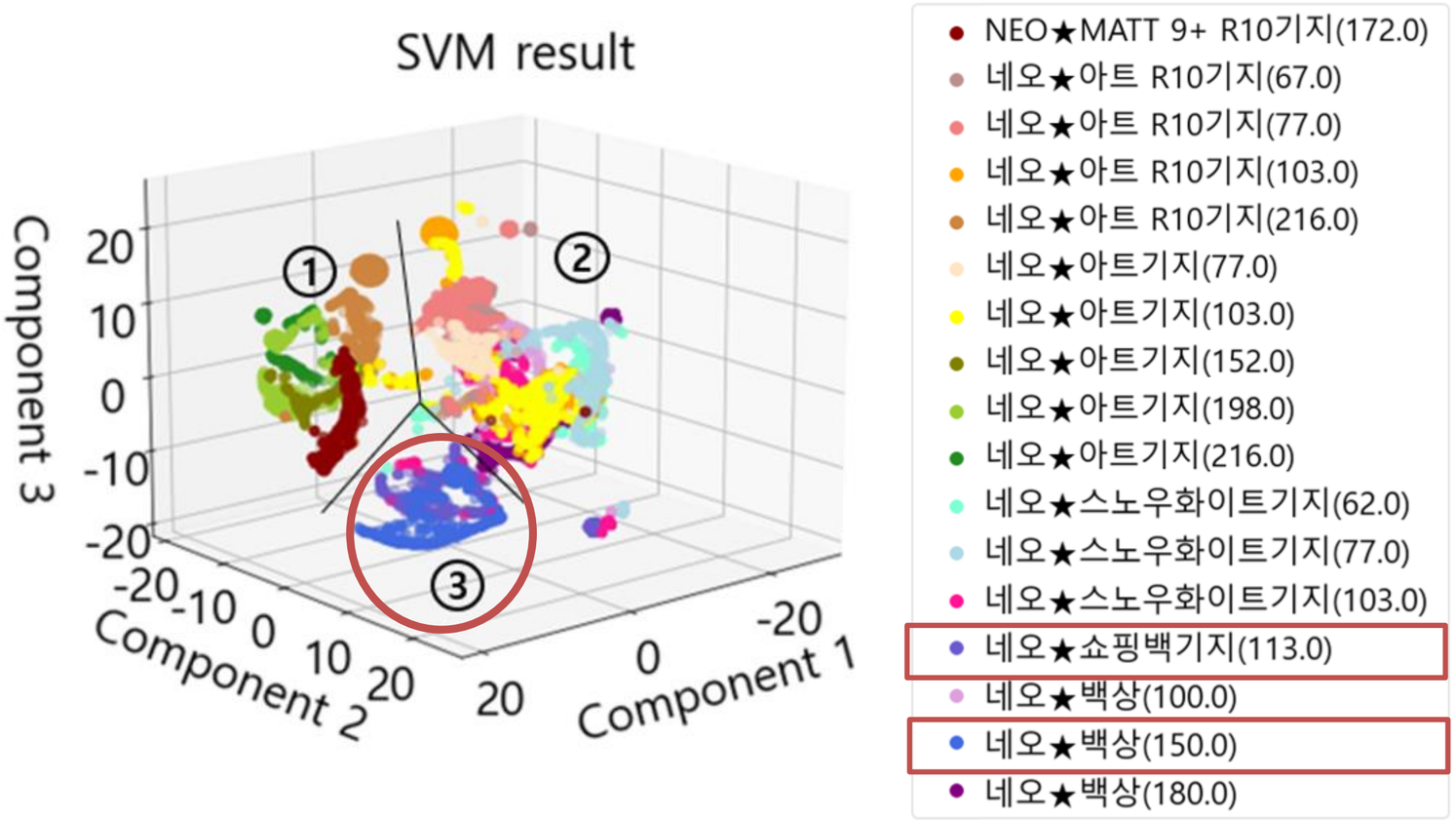
4.t-SNE



저평량

- 103
- 100
- 77
- 67
- 62

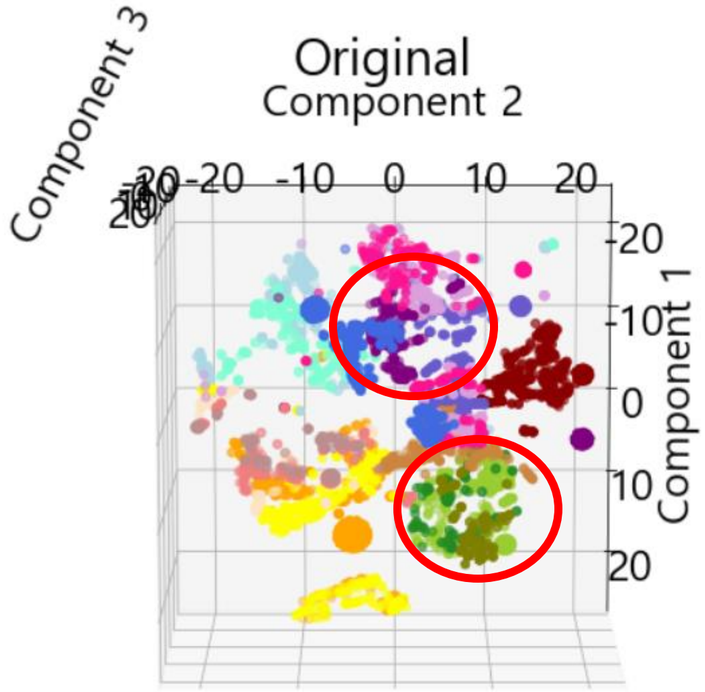
4.t-SNE

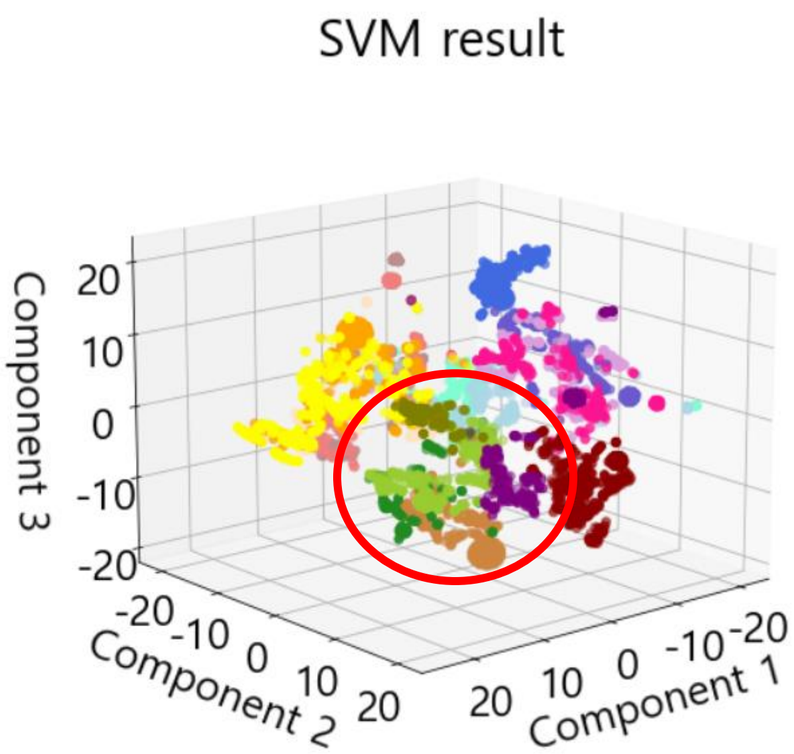


중평량

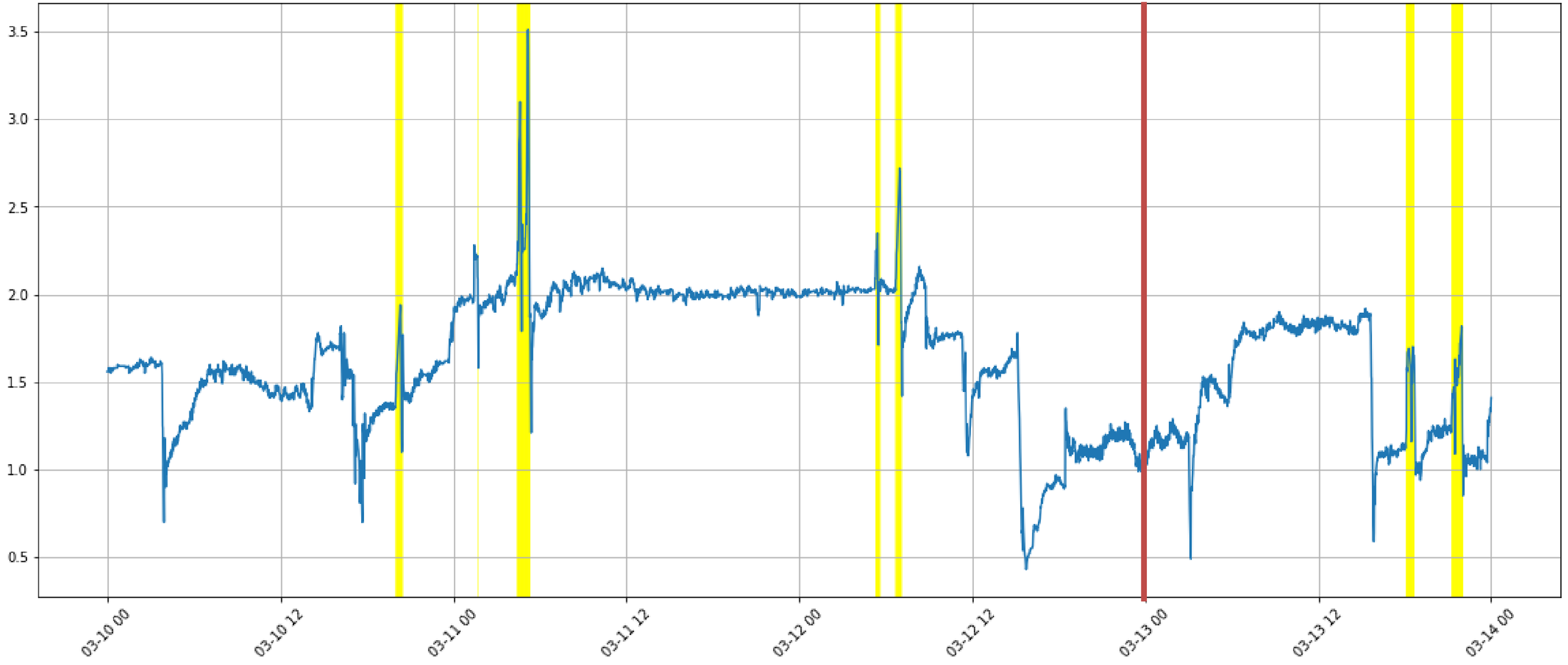
- 103
- 100
- 77
- 67
- 62

4.t-SNE

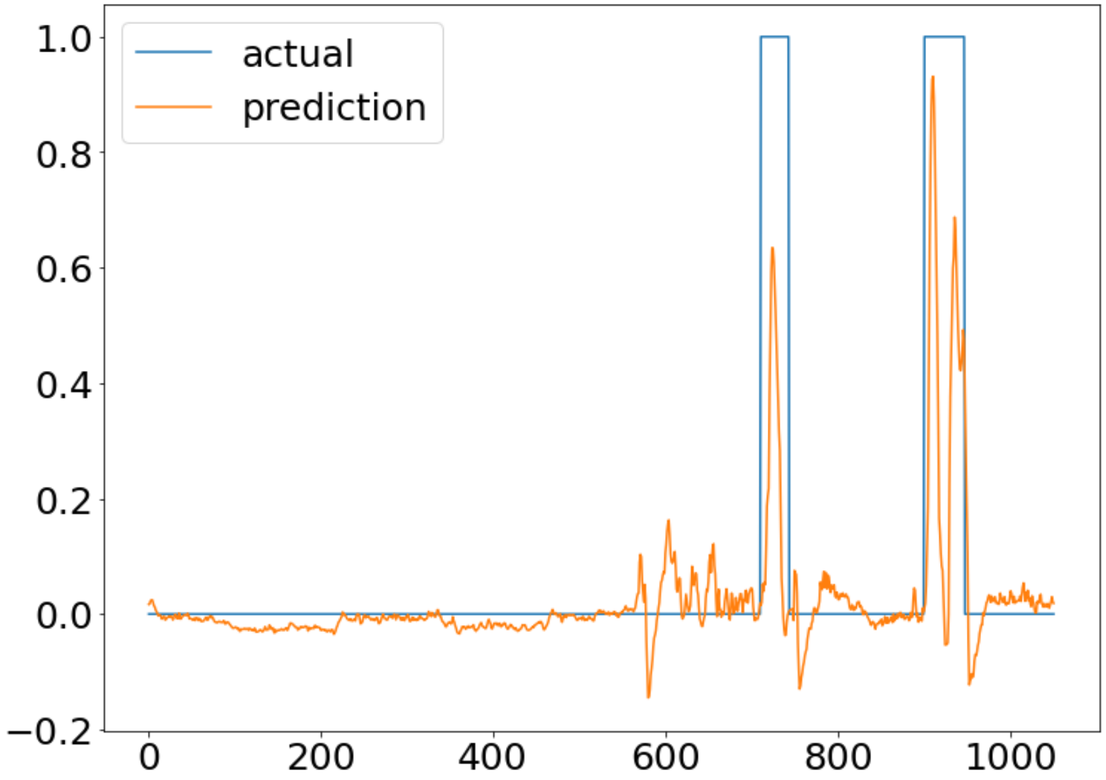

Original
Component 2
Component 3
Component 1
-20
-10
0
10
20


SVM result
Component 3
Component 2
Component 1
20
10
0
-10
-20

5.LSTM


3.5
3.0
2.5
2.0
1.5
1.0
0.5
03-10 00
03-10 12
03-11 00
03-11 12
03-12 00
03-12 12
03-13 00
03-13 12
03-14 00

5.LSTM



Sensor

320PIC7513:me	4nd pre-dry group
PM3-S5SC.opr:me	5G steam pressure
320PIC7544:me	Steam box pressure
320PIC7508:me	3rd dry cylinder
320PDC7516:me	1st dry group
320PIC7505:me	1st dry cylinder pressure
320PIC7514:me	5th bottom dry group
320PDC7520:me	4th dry group
320PIC7509:me	1st dry group
PM3_ASH_PV	회분량

Power

HFEMS.MRPAP.01.SH01.PL003.04.PF	DRIVE #1,2 역률
HFEMS.MRPAP.01.SH01.PL003.02.PF	초지저압 1,3 CONTROL역률

01월 13일 과제 발표

THANK YOU

FEMS DATA ANALYSIS