실험제목	센서 기반 제소 공정을 위한 인공지능	
실험목적	반도체 제소 공정의 센서 데이터를 이용한 생성 공정 관리	
네경		
경쟁이 기열하고, 저	기품의 변화가 빠르기 때문에 생산 공정의 유연한 조정과	
제품출시 시간 단	寺亡 叶子 圣色 弦	
IOT 센서의 발전으	로 세조 공정에서 다양한 데이터 수집이 가능해 졌으며, 그	
데이터를 이용한 공	F전 관리는 복잡 레지고 있음.	
제조 공정 관리를	위해서 빅데이터 와 인공지능 기술의 결합을 통해 유연하고	
네바른 공정 관리가	가 가능할 것으로 예상된.	
반도체 제조 공정	데이터 (SECOM) 을 이용하여 생산 공정 관리를 위한	
기계 학습 准을	직용할 방법 연구.	
실험 설계		
1. 데이터 분석할	위한 알고리즘 선택	
- Boruta	·	
- Multivariate	Adaptive Regression Spline (MARS)	
-PCA		
2. 분류 알고각증		
- Rlogistic F	Regression (LR)	
- Random Fores	t (RF)	
- Rradient 130	osted Trees (GIBT)	
7 712		
3. Ith		
- FPR		
- Precision		
- recall		
- F-meusure		
- accuracy		
기록자 Written by	점검자 Witnessed or Understood by 점검자 Witnessed or Understood	by
김민태		
일자	일자	
' /		

실험제목	센서 기반 제조 공정을 위한 인공지능
실험목적	반5체 제조 공정의 센서 데이터를 이용한 생성 공권 관리
테이터 분석.	
-/00개 이상의 단계	I로 7%된 반5체 궤조 공정 에서 수집된 데이터
-1567개의 샘플 E	11 015
	기계의 특성을 가짚.
	なの 'NaN'으로 温
- 제품에 문제가	있는 경우 1, 정상인경우 -13 나타범
실험 설계	
1901 0 -> feat	ure 후 -> 교차 검증 -> 생존 김> 생존 김> 생존 김>
	-> 테스트 데이터 /
	李皇
	1月7十/
1 8/05/ 2/2/2/	
/ 데이터 건치기	4. 샘플링
-72=21 71/7	- 불교형 데이터
- EHOLET [9, 0]	- 2 버 성플링
2. feature 辛季	
- Bruta	5. 알고리즘 선택
- MARS	- RF
- PCA	- LR
3 72 72 73	- GBT
	11 7 7
-k-Fold cross	Valldation
기록자 Written by	점검자 Witnessed or Understood by 점검자 Witnessed or Understood by
김민태	
일자   / 8	일자

실험제목	센서 기반 제조 공전	를 위한 인공기	18
실험목적	반도레 제조 공정의	센서 데이터를 이	용한 생산공정 관리
데이터 건치각			
-55% 이상 테이터가	결측된 경우 해당 특	성계거	
120			
Number of Features		- 각 생 플	데이터에서 결혼감수
- Pea -		八分堂	,
uper d			의 특성중 과개가
		제거되	
	ននាក់ក្នុងនេះត្រូវក្រុងក្រុងក្រុងក្រុងក្រុងក្រុងក្រុងក្រុង		특성을 고려하여
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化,市场省人	NV 1 2 1 65 6 7	るなべき	15 01%
		F 1/2/ 3 -19	-11 -121
	하여 총 1/6개의		
	상 그며, 다금과 같은		
- 451 개의 특성이	남 그며, 다금과 같은		
	남 그며, 다금과 같은		
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$-45 744 540 $ $x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}}$	남 그며, 다금과 같은	स्यह हुआ ट	0~13 정규각
$-451 개의 특성이$ $-x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}}$ $+ \cot ure                                  $	남 그며, 다금과 같은	स्यह हुआ ट	
$-451 개의 특성이$ $-x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}}$ $+ \cot ure                                  $	남 그며, 다금과 같은 의 흥士 특정 제거 BLE II URES SELECTION TECHNIQUES	स्यह हुआ ट	아 13 정규 <i>라</i> 번의 반복 <i>수</i> 행은 통해
$-451 개의 특성이$ $x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}}$ $+ \cot u + \frac{2}{5}$ $- 분류에 의하는 미2$ $COMPARISON OF THE FEAT$	남 그며, 다음과 같은  IP 양분 특정 제거  BLE II  URES SELECTION TECHNIQUES  or of Characteristics  reatures	-Boruta는 766 22개의 특성	아 13 정규 <i>라</i> 번의 반복 <i>수</i> 행은 통해
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$ x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}} $ $ + \frac{1}{2} + \frac$	보고며, 다음과 같은  IP 등급 등정 제가  BLE II  URES SELECTION TECHNIQUES  or of Characteristics  reatures  by default it uses the Random Forest (RF) algorithm it is a form of	-Boruto 는 766 22개의 특성 -MARS는 10개의 특성을	아 13 정규 <i>라</i> 번의 반복 수행을 통해 수출 R 558와 GCV를 기반으로 근 추출
$ x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}} $ $ + \frac{1}{2} + \frac$	BLE II URES SELECTION TECHNIQUES or of Characteristics reatures  by default it uses the Random Forest (RF) algorithm it is a form of regression analysis it uses orthogonal	-Boruto 는 766 22개의 특성 -MARS는 10개의 특성을	아 13 정규화 번의 반복 수행을 통해 추출 R 5584 GCV를 기반으로
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	나는 그 나는 가 같은  IT 는 등성 제가  BLE II  URES SELECTION TECHNIQUES  Fro of Characteristics  The features by default it uses the Random Forest (RF)  algorithm it is a form of regression analysis it uses orthogonal linear transformations	-Boruta는 766 22개의 특성 -MARS는 10개의 특성을 -PCA는 111기	사이 반복 수행을 통해 추출 R55와 GCV를 기반으로 구출 네비 특성을 추출
$-45 749  = 50$ $x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}}$ $-\frac{1}{2} = \frac{1}{2} = \frac{1}{2}$ $-\frac{1}{2} = \frac{1}{2} = \frac{1}{2} = \frac{1}{2}$ $-\frac{1}{2} = \frac{1}{2} = \frac{1}{2} = \frac{1}{2}$ $-\frac{1}{2} = \frac{1}{2} = \frac{1}{2}$	나는 그 나는 가 같은  IT 는 등성 제가  BLE II  URES SELECTION TECHNIQUES  Fro of Characteristics  The features by default it uses the Random Forest (RF)  algorithm it is a form of regression analysis it uses orthogonal linear transformations	-Boruto 는 766 22개의 특성 -MARS는 10개의 특성을	아 13 정규 <i>라</i> 번의 반복 수행을 통해 수출 R 558와 GCV를 기반으로 근 추출
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실험제목		공정을 위한 인공기	
실험목적	반도체 제소 공정	의 센서 데이터를 이	용한 생산 공정 관리
샘플링			
-소수 클래스와	다수 클레스의 불편	3형 문제	
- 1567개의 데이	터 중 104개는 실 :	때, 1463개는 선	공 데이터
- 1:14의 비율로	불균형 데이터임.		
Nur	nber of Samples		
		-불 균형을 해	결하기 위해 다수 큰 대스에서
1200 1000		무작위로 데이	터를 뿔는 언터 샘플링 이
800			
_ 600 400		- 소수 클 레스를	복사하는 오버 샘플링 이용
_ 200			7 - 020 6
– Fails	Passes	-	
_ Fig. 6. Initial Distribution o	of the Fail Samples and the Pass San	nples	
1 -1 -1 -			
	Spread Sub Sample		
- 오버 샘플링에는	Synthetic Minor	ity Oversampling	Technicque 018
데이터 분할			
	▲ 테스트 데이터를	+ + 4 1 / 80%	(20%) 引 基計
(50) VA			120,072 122
- 9 FU 71 40 9	1 1 200	5	
- 모델 검증을 위			1- C (11
- k-fold cross	validation of \$ 31		= 5-fold cross
- k-fold cross Validation 이탈	validation ol & 31	역, 5개로 분할 리	
- k-fold cross Validation 이탈	validation ol & 31	역, 5개로 분할 리	
- k-fold cross Validation 이탈	validation ol & 31	역, 5개로 분할 리	
- k-fold cross validation 이용 -모델 평가에는 (FPR)을 이용	Validation of & 3th	기, 5개로 분할 하 II, Precision, Acci	racy, False Positive R
- K-fold cross Validation 이용 -모델 평가에는 (FPR)을 이용	Validation of & 3th	기, 5개로 분할 하 II, Precision, Acci	
- K-fold cross Validation 이용 -모델 펴가에는 (FPR)을 이용	Validation of & 3th	기, 5개로 분할 하 II, Precision, Acci	racy, False Positive R
- K-fold cross validation 이용 -모델 퍼가에는 (FPR)을 이용	Validation of & 3th	기, 5개로 분할 하 II, Precision, Acci	racy, False Positive R
- K-fold cross Validation 이용 -모델 펴가에는 (FPR)을 이용	Validation of & 3th	기, 5개로 분할 하 II, Precision, Acci	racy, False Positive R
- k-fold cross  Validation 이용 - 모델 평가에는  (FPR)을 이용 - 테스트 데이터	Validation 이용하다 F-measure, reco	기, 5개로 분할 하 II, Precision, Acco 경증하기 위해 산	Tracy, False Positive R 플링은 적용하기 않음.
- k-fold cross  validation 이용 -로밀 퍼가에는  (FPR)을 이용 -테스트 데이터  기록자 Written by	Validation 이용하다 F-measure, reco	기, 5개로 분할 하 II, Precision, Acci	racy, False Positive R
- k- fold cross  VALIDATION 이용 -모델 퍼가에는  (FPR)을 이용 -테스트 데이터  기록자 Written by 김 민 태	Validation 이용 하다 F-Mea Sure, reco	기, 5개로 분할 하 II, Precision, Acco 경증하기 위해 산	Positive R 프랑은 적용하기 않음. 점검자 Witnessed or Understood
- k-fold cross validation 이용 -로텔 평가에는 (FPR)을 이용 -테스트 데이터 이	Validation 이용하다 F-measure, reco	기, 5개로 분할 하 II, Precision, Acco 경증하기 위해 산	Tracy, False Positive R 플링은 적용하기 않음.

보유를 알고리즘  - LR는 Broy den - Fletcher - Gold ford - Shartno (LIB F 0/5) 알고리즘 이용  - Rendom Forest 는 다음과 같이 구설  TABLE III  RANDOM FOREST PARAMITERS  Parameter Value Description under of 2 the aumber of classification classes number of 2 the sample of the forest framework of the maximum number of 10 the maximum number of the number	실험제목	센서 기반 제조 공정	를 위한 인공지능		
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Rendom Folest 는 다음과 같이 권 TABLE II RANDOM FOLEST PARAMETERS  Parameter Value Description number of 2 neumber of classes number of 10 neumber of the maximum depth of the trees from the forest how many features to use as candidates for splitting inputity "gity" in parameter that describes how many features to use as candidates for splitting are used to discretize the forest how many features to use as candidates for splitting are used to discretize the features  - OBT는 다음과 같이 구성  TABLE IV GRADIENT BOOSTED TREES PARAMETERS  Parameter Value Description number of classes 2 the maximum depth of the trees  - OBT TABLE IV GRADIENT BOOSTED TREES PARAMETERS  Parameter Value Description the maximum depth of the trees  - TABLE VI SAMPLING METHOD  Sampling Method Description Unsampled the number of samples is unchanged the number of samples of the	부류 알고리즘				
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TABLE III RANDOM POREST PARAMETERS  Parameter Value Description number of 2 the number of classification classes number of 100 many trees are in the forest the forest strategy inpurity "giny" a parameter that describes how many features to use as candidates for splitting inpurity "giny" a parameter that describes the homogeneity of the labels the homogeneity of the labels the homogeneity of the favore of the maximum depth 20 the maximum depth of the trees from the forest the homogeneity of the labels the maximum depth of the trees from the forest the maximum depth of the trees from the forest the maximum depth of the trees from the forest the maximum depth of the trees from the forest the maximum depth of the trees from the forest the maximum depth of the number of classification classes and the number of classification classes and the number of tiention s 3 cach iteration creates a tree maximum depth of the trees  TABLE VII SAMPLING METHOD  Sampling Method Description  Undersampled Majority Class the number of samples is unchanged the number of samples of the majority class is reduced to 78 the number of samples of the majority class is increased to 1176	20				
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