Artificial Intelligence

PBL3

Team 6

01. SVM using GPU

01

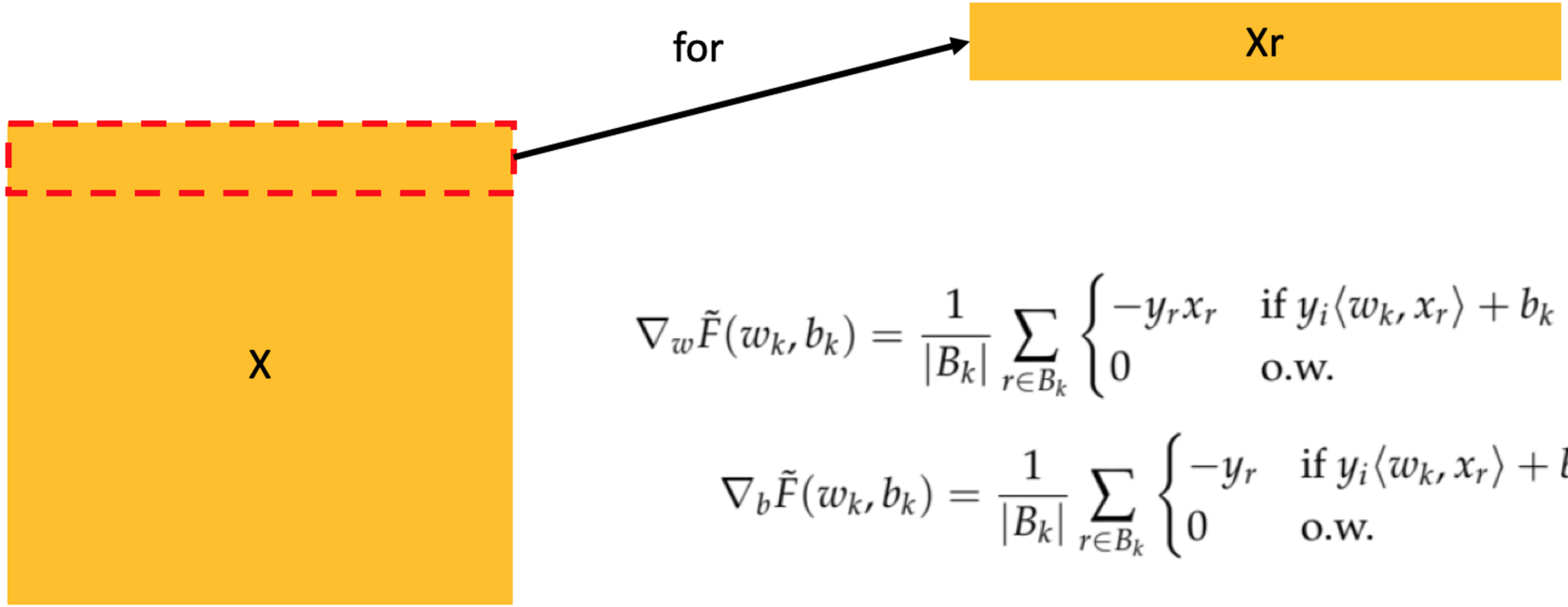
02

03

04

>> Using “for loop” (numpy)

_SGD(X, y, W, b, batch_idx)



$$\nabla_w \tilde{F}(w_k, b_k) = \frac{1}{|B_k|} \sum_{r \in B_k} \begin{cases} -y_r x_r & \text{if } y_i \langle w_k, x_r \rangle + b_k \leq 1 \\ 0 & \text{o.w.} \end{cases} + \lambda w_k$$

$$\nabla_b \tilde{F}(w_k, b_k) = \frac{1}{|B_k|} \sum_{r \in B_k} \begin{cases} -y_r & \text{if } y_i \langle w_k, x_r \rangle + b_k \leq 1 \\ 0 & \text{o.w.} \end{cases}$$

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>> Not using “for loop” (cupy)

_SGD(X, y, W, b, batch_idx)

$$\nabla_w \tilde{F}(w_k, b_k) = \frac{1}{|B_k|} \begin{cases} -yx & \text{if } y * (W^T \cdot X + b) \leq 1 \\ 0 & \text{o.w.} \end{cases} + \lambda w_k$$

$$\nabla_b \tilde{F}(w_k, b_k) = \frac{1}{|B_k|} \begin{cases} -y & \text{if } y * (W^T \cdot X + b) \leq 1 \\ 0 & \text{o.w.} \end{cases}$$

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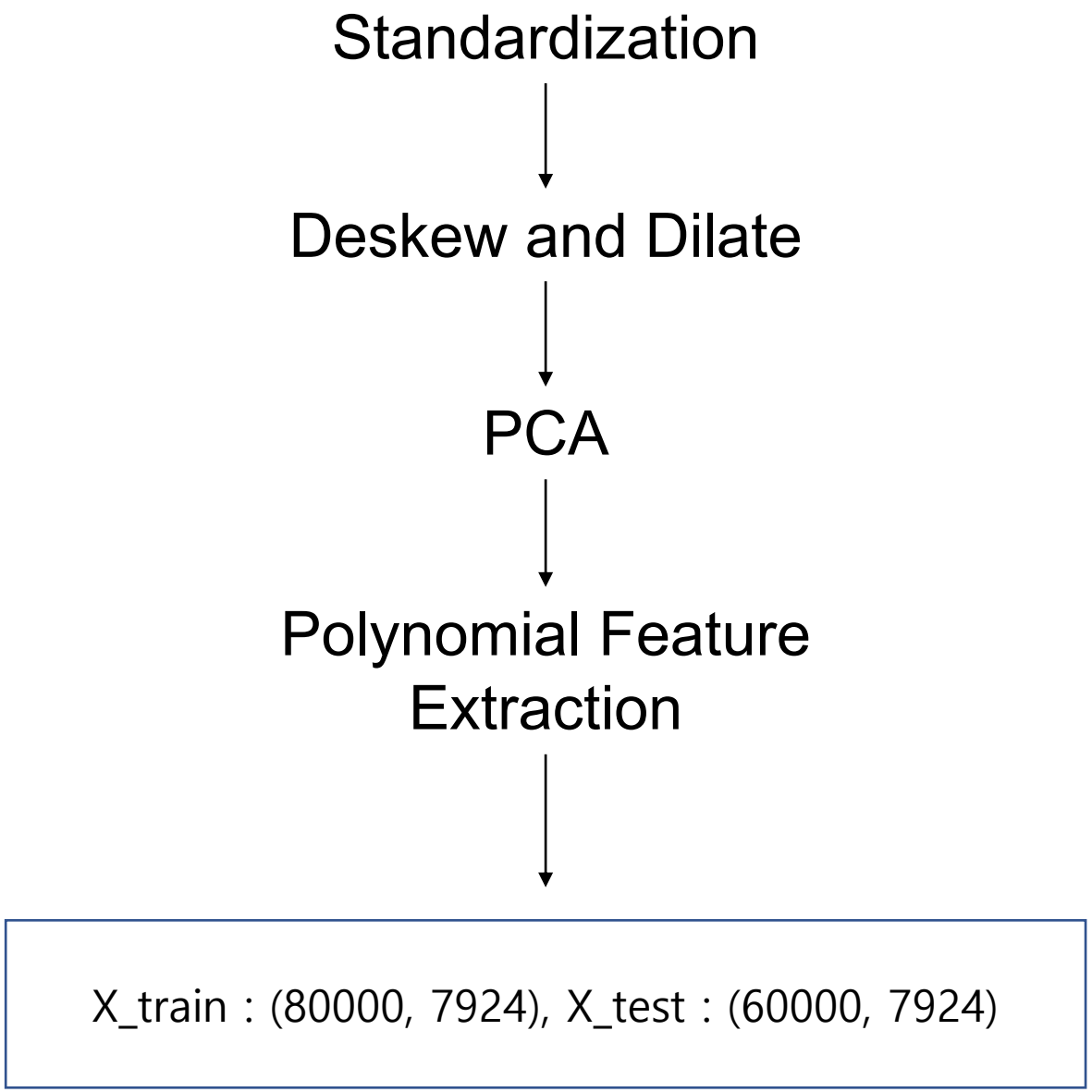
>> Not using “for loop” (cupy)

one_hot(y)

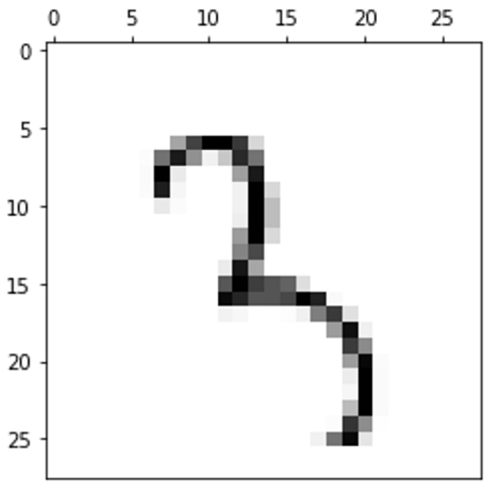
02. Preprocess & Feature Extraction

>> Process


Standardization
Deskew and Dilate
PCA
Polynomial Feature Extraction
X_train : (80000, 7924), X_test : (60000, 7924)

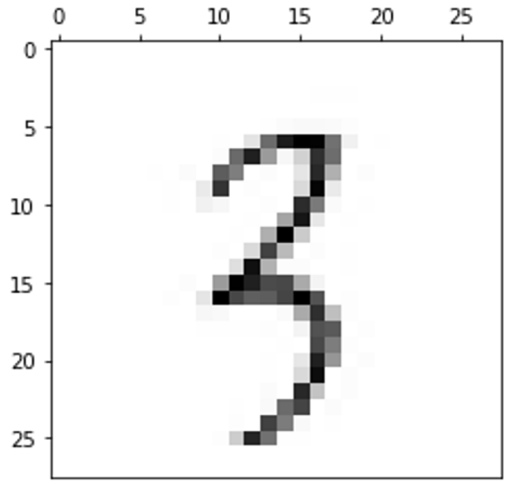
>> Preprocessing - Deskew and Dilate

cv2.dilate(img, kernel=(2,2) , iterations = 1)



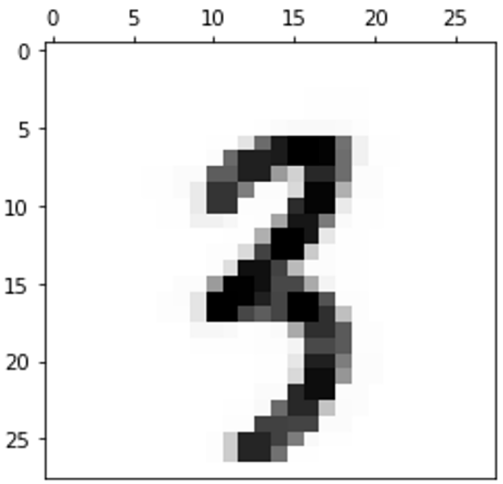
origin

>>



deskew

>>

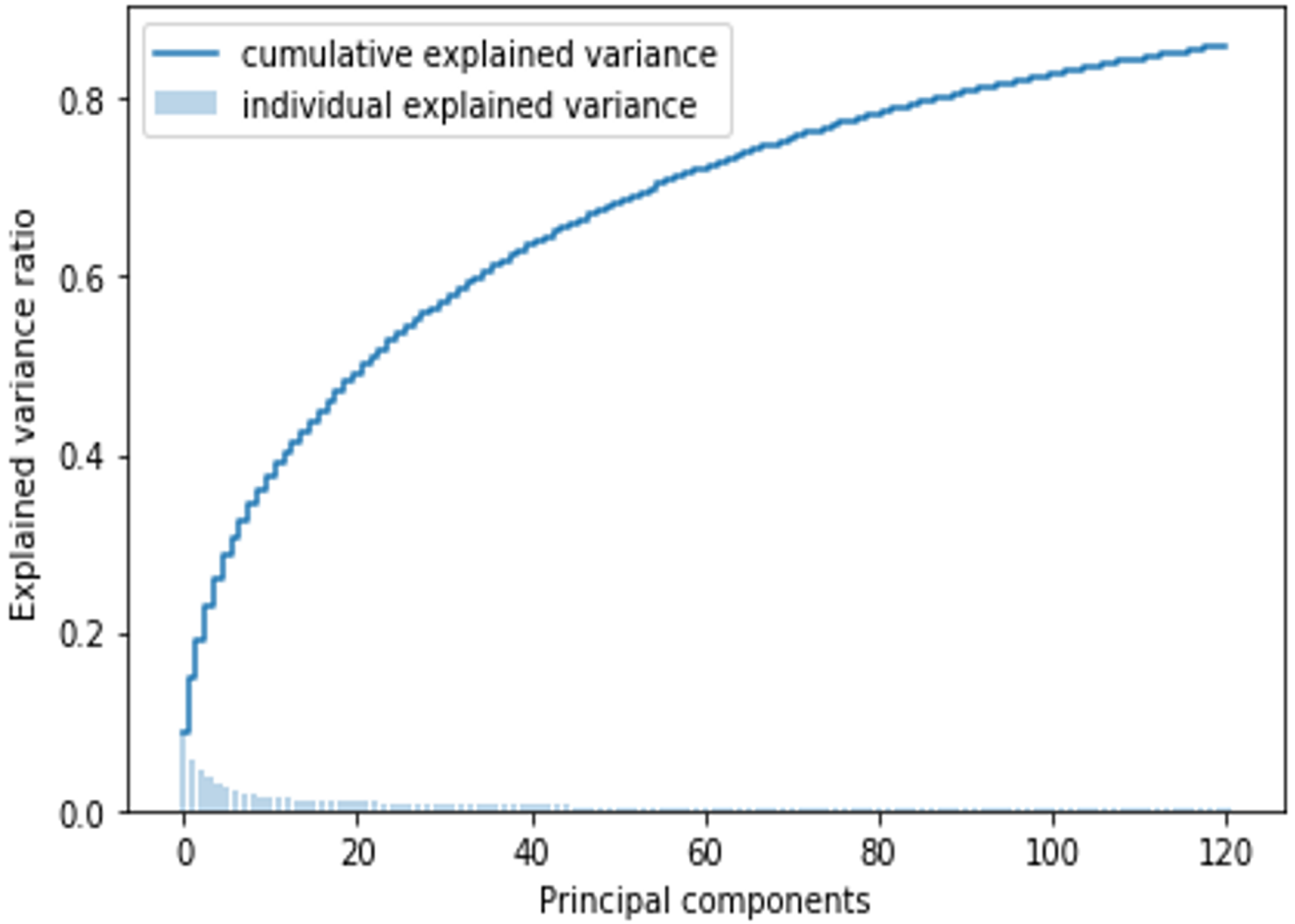


dilate

>> Principal Components Analysis

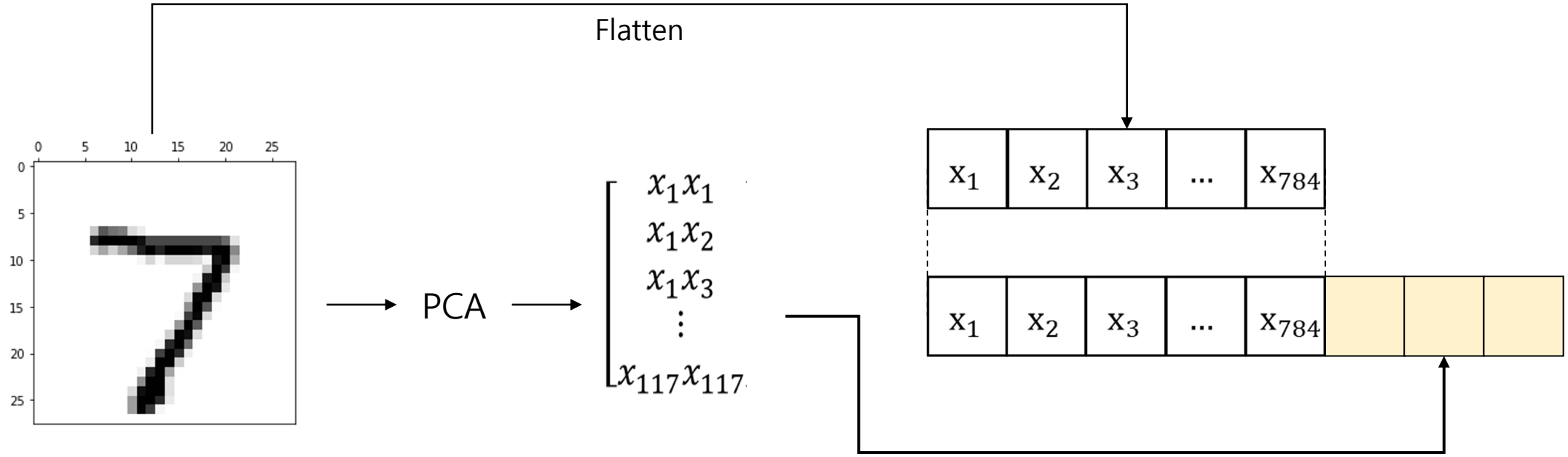
Principal component	Eigenvalue	Cumulative variance
1	69.7181	0.08926
2	45.2179	0.1471
3	35.4805	0.1925
4	28.8478	0.2295
5	24.0394	0.2603
...	...	...
120	1.1345	0.8590
121	1.1182	0.8604

PCA(n_components = 0.86)

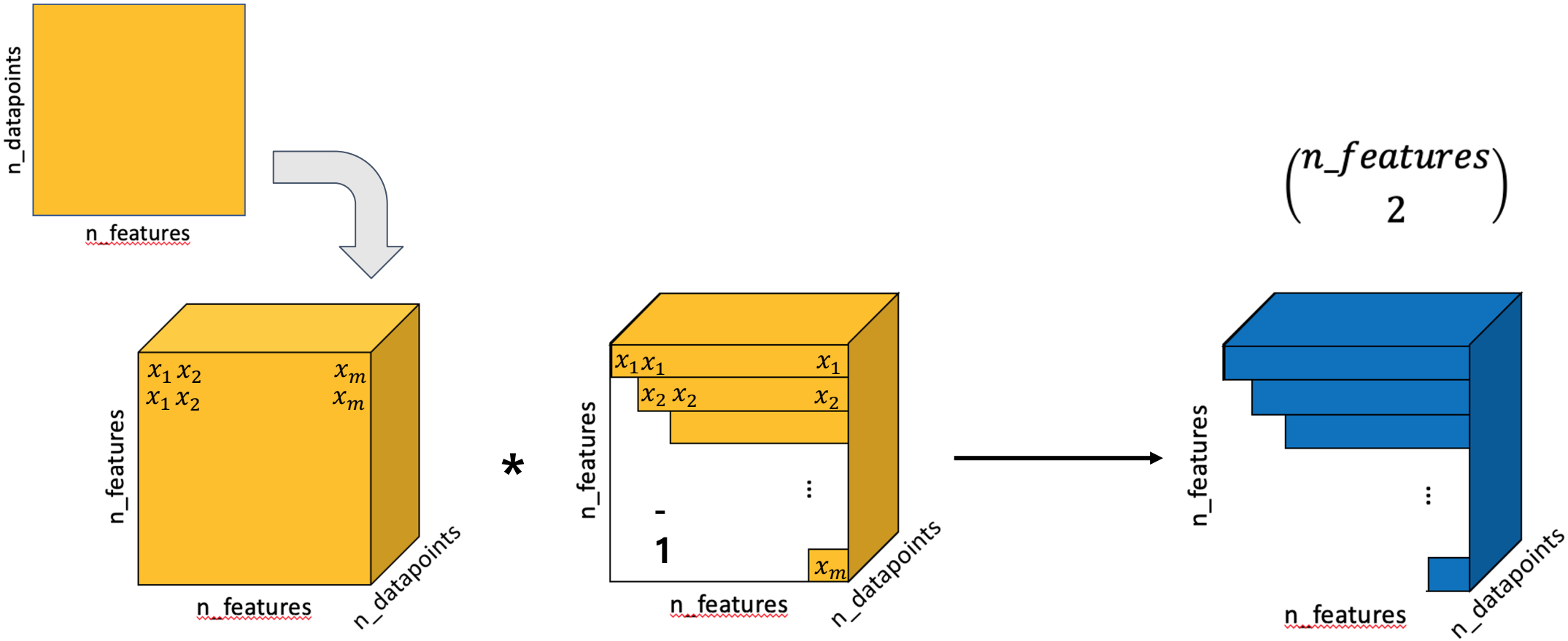


>> Polynomial Feature Extraction

```
from sklearn.preprocessing import
PolynomialFeatures
poly_features = PolynomialFeatures(degree=2)
```



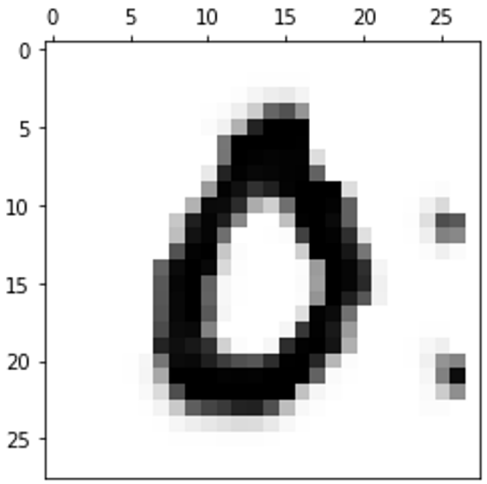
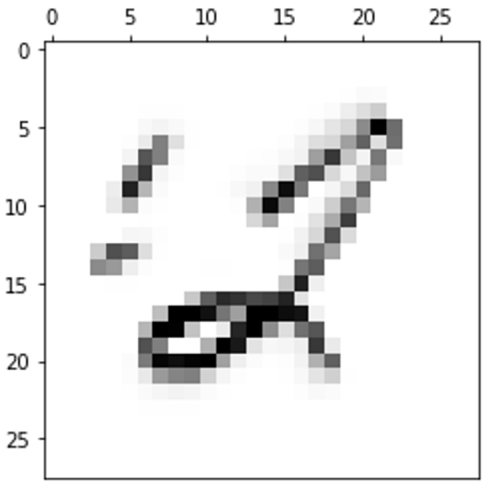
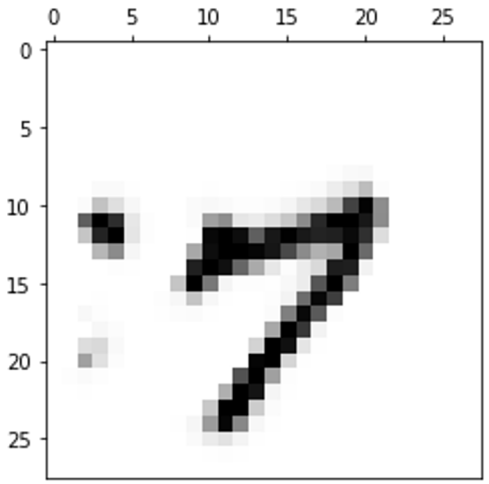
>> Polynomial Feature Extraction - our implementation



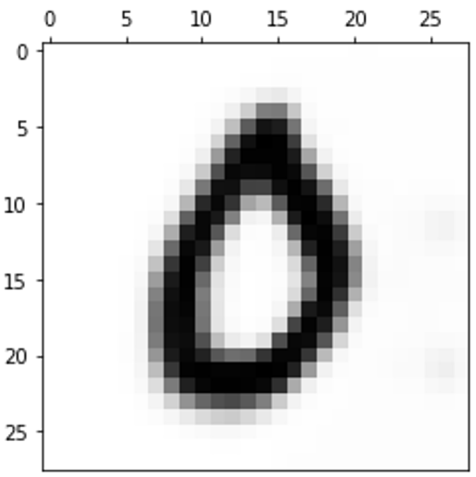
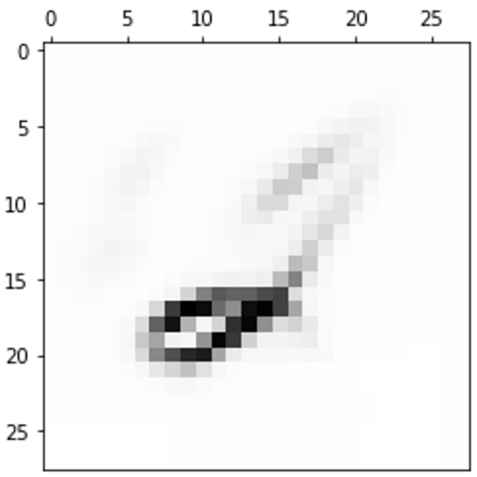
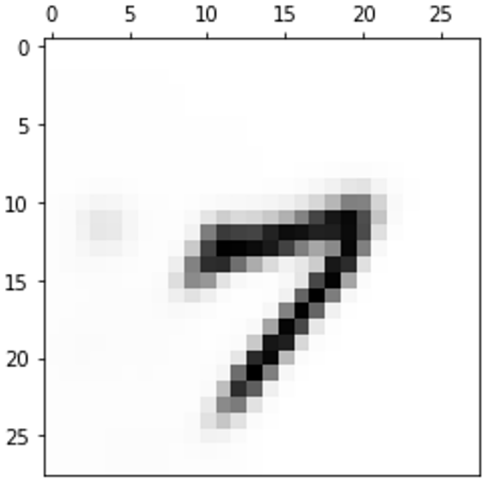
-> Too much computation!!

>> Polynomial Feature Extraction
crop image to reduce features and remove outlier

outlier...

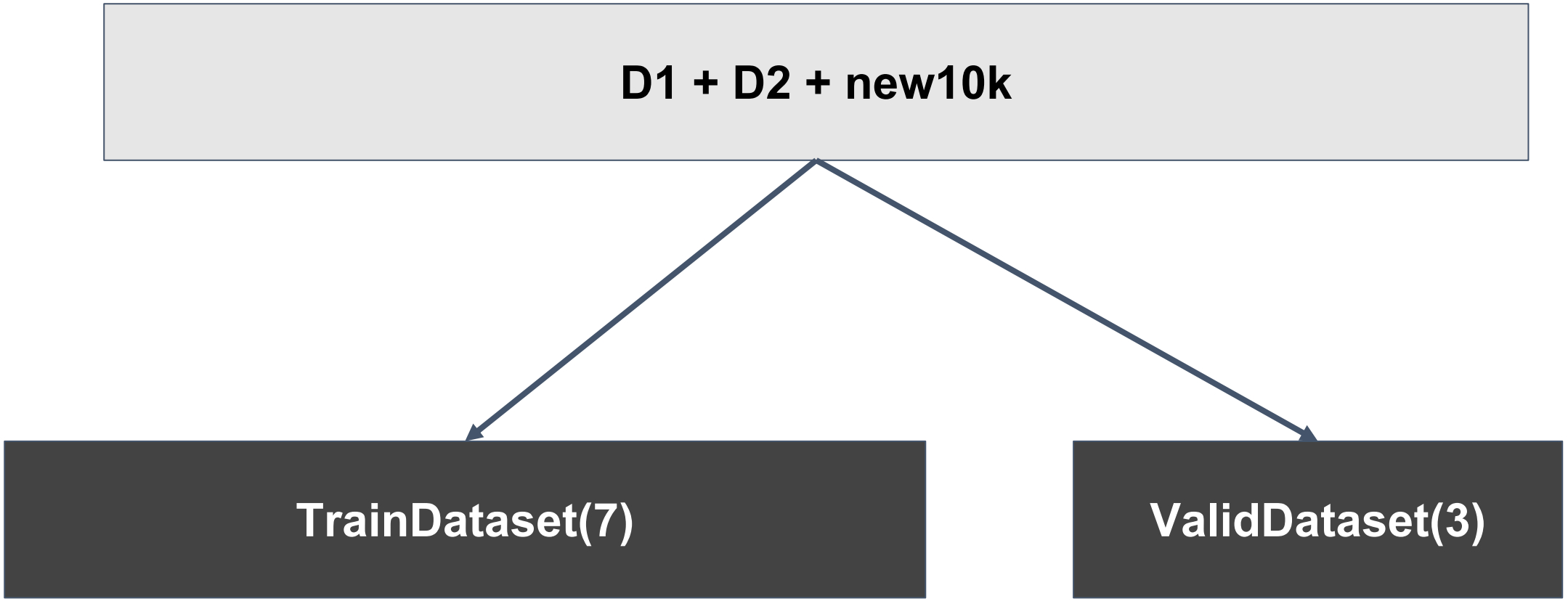




cv2.fastNlMeansDenoising(img, None, 50.0, 7, 21)

03. Hyperparameter Tuning

>> Dataset



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>> Hyperparameter tuning

pbl2 – max_iter=200

12min 14s

pbl3 – max_iter=500

1min 55s

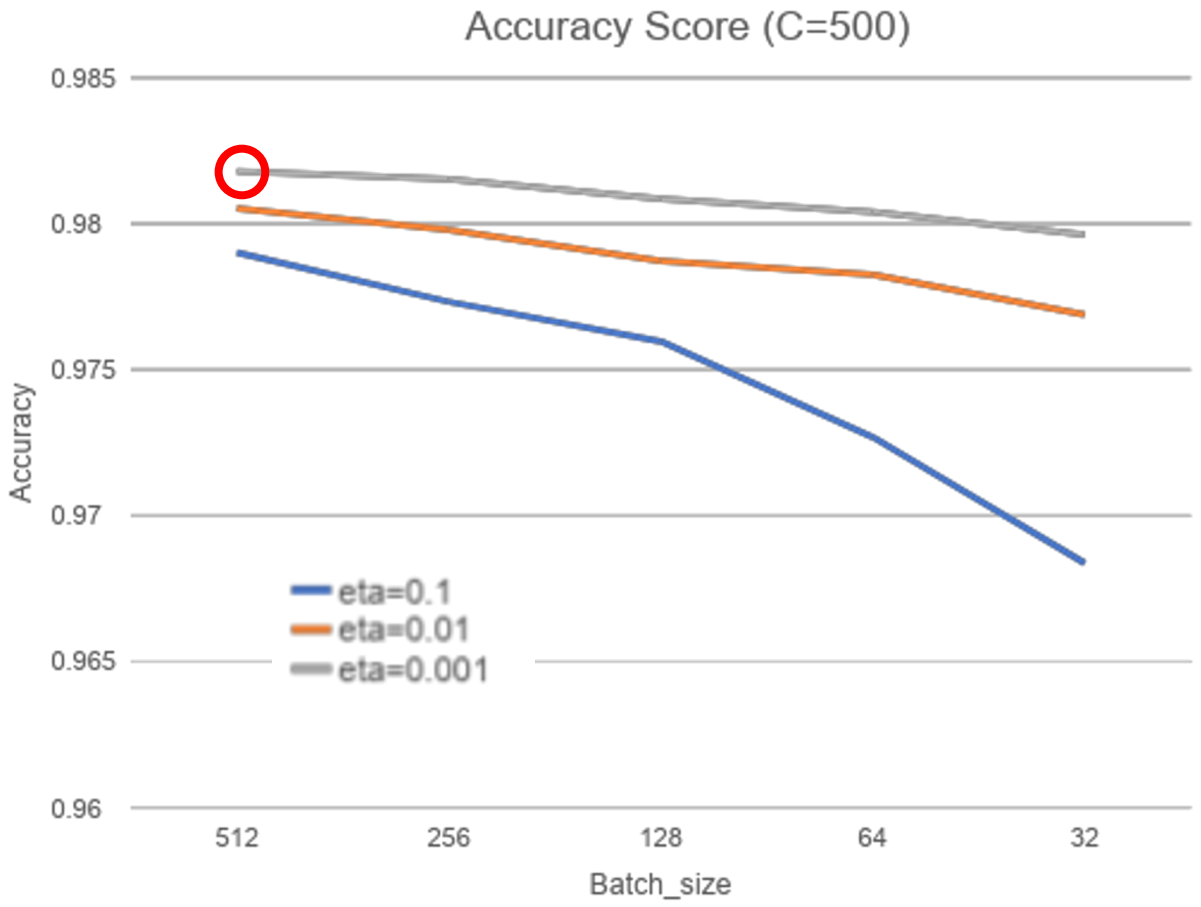
```
param_grid = [{

    'C ' : [100, 200, 300, 500, 700, 1000]
    'eta' : [0.1, 0.01, 0.001]
    'max_iter' : [500]
    'batch_size' : [16, 32, 64, 128, 256, 512]

}]
```

>> Hyperparameter tuning

Rank	C	eta	Batch_size	Accuracy
1	**500**	**0.001**	**512**	**0.981792**
2	500	0.001	256	0.981533
3	1000	0.001	512	0.98148
4	700	0.001	256	0.981375
5	100	0.01	512	0.981317
6	1000	0.001	256	0.98125
7	200	0.01	512	0.980992
⋮	⋮	⋮	⋮	⋮



Q & A

Thank you :)