

CA3

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بخش اول)

تمرین 1-1)

```
Nch=32;  
mapset=cell(2,Nch);  
Alphabet = 'ABCDEFGHIJKLMNOPQRSTUVWXYZ ,;?!.!';  
for i=1:Nch  
    mapset{1,i}=Alphabet(i);  
    mapset{2,i}=dec2bin(i-1,5);  
end
```

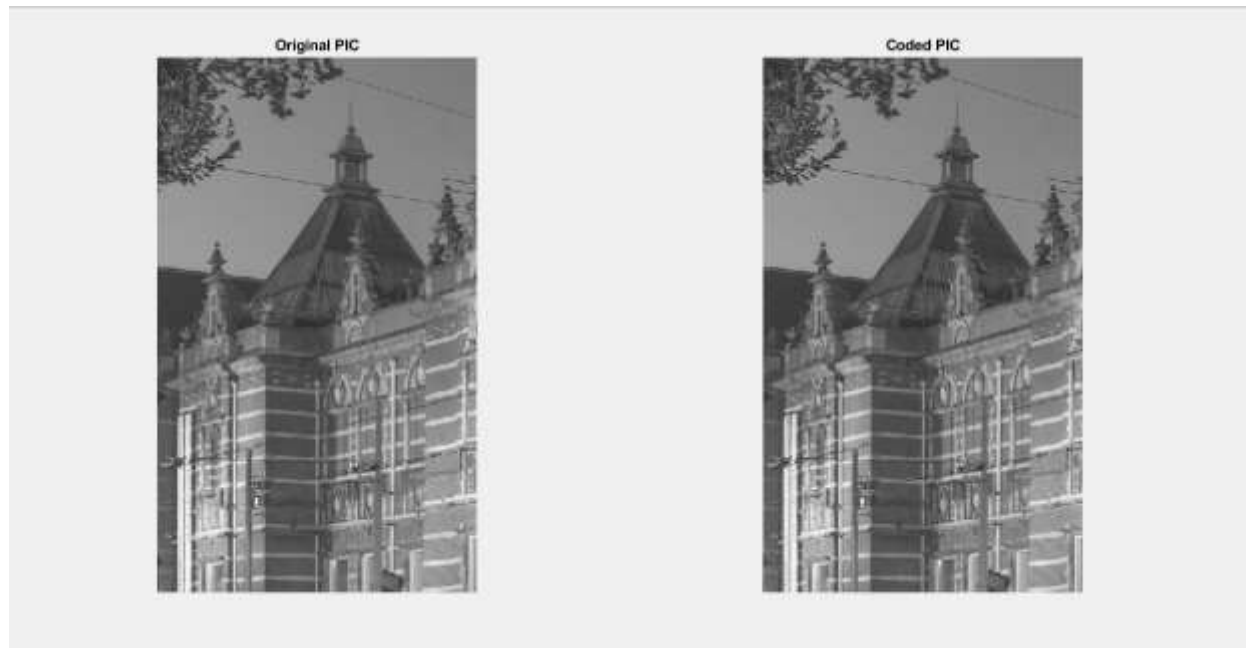
با توجه به خواسته سوال در اینجا یک سلول 2 در 32 با نام گفته شده می سازیم و سپس تک تک داده ها را به این سلول می کنیم ، ردیف اول خود حروف و ردیف دوم عدد باینری 5 بیتی متناظر آن است.

بخش 1-2)

```
function output_img = coding (message, input_img, mapset)  
Nch = 32;  
message_len=length(message);  
message_bin=cell(1,message_len);  
for i=1:message_len  
    ch=message(i);  
    for j=1:Nch  
        if ch==mapset{1,j}  
            message_bin{i}=mapset{2,j};  
        end  
    end  
end  
  
binarymessage=cell2mat(message_bin);  
binarymessage_len=length(binarymessage);  
Y=input_img;  
  
for i=1:binarymessage_len  
    vals=input_img(i);  
    valsbin=dec2bin(vals);  
    valsbin(end)=binarymessage(i);  
    Y(i)=bin2dec(valsbin);  
end  
output_img = Y;
```

در قسمت بالا کد تابع coding آمده است.

(1-3)



عکس خروجی تصویر خواسته شده در این بخش.

```
figure
plot1=subplot(1,2,1);
imshow(X)
title('Original PIC')
plot2=subplot(1,2,2);
imshow(output_img1)
title('Coded PIC')
linkaxes([plot1 plot2])
```

برای رسم کردن تصاویر از دستور plot استفاده می‌کنیم.

(1-4)

(1-5)

خیر اگر در پیام نویزی ایجاد شود قادر نخواهیم بود پیام را به درستی استخراج کنیم به علت آنکه در رمزنگاری تصویر بی ارزش ترین بیت را تغییر می‌دهیم احتمال تغییر آن به علت نویز زیاد است.

بخش دوم)

بخش سوم)

کافیاست عکس IC را بر روی عکس PCB حرکت دهیم و در هر مرحله همبستگی یا همان correlation بین IC و آن قسمت از PCB که IC بر روی آن قرار گرفته را اندازه گیری کنیم. اگر این مقدار، از میزان مشخصی بیشتر شد، میتوان گفت الگوی مورد نظر را پیدا کرده ایم.



برای تابع `image_select` تابع `imgetfile` رو درون تابع `imread` تعریف میکنیم؛ خروجی این تابع یک ماتریس سه بعدی از تصویر ورودی به این تابع خواهد بود.

برای خاکستری کردن تصویر طبق فرمول داده شده هر کانال رو در ضریب مربوط به خودش ضرب میکنیم ؛ چون تمام درایه ها رو لازم داریم از فرمت `(num Channel:,:)` استفاده میکنیم.

برای نوشتن تابع `d2_corr` چون سیگنالها دو بعدی هستن از فرمت `(sum(sum(x)))` استفاده میکنیم و رابطهای که در بخش 2 مفهومی بدست آوردیم رو پیاده سازی کنیم.

```

function corr = corr_2d(x,y)
    sum_xy = sum(sum(x .* y));
    sum_x2 = sum(sum(x .* x));
    sum_y2 = sum(sum(y .* y));

    corr = sum_xy / sqrt(sum_x2 * sum_y2);
end

```

برای کم کردن میانگین سیگنالها از خودشان از فرمت `mean(X,'all')` استفاده میکنیم؛ کد داده شده رو کامل میکنیم این کد تصویر خاکستری قطعه رو از بال سمت چپ مدار چاپی روی این تصویر حرکت داده و در هر قسمت `correlation` دو بخش رو با هم حساب میکنه . در نهایت این فرآیند رو به کمک تابع `surf()` رسم میکنیم.

```

function M = corr_matrix(PCB,IC)
    [PCB_row,PCB_col] = size(PCB);
    [IC_row,IC_col] = size(IC);
    IC = double(IC);
    IC = IC - mean(IC,'all');
    M = zeros(PCB_row - IC_row + 1, PCB_col - IC_col + 1);
    for i=1:(PCB_row - IC_row + 1)
        for j=1:(PCB_col - IC_col + 1)
            PCB_cropped = double(PCB(i:i + IC_row - 1, j:j + IC_col - 1));
            PCB_cropped = PCB_cropped - mean(PCB_cropped,'all');
            M(i,j) = corr_2d(PCB_cropped,IC);
        end
    end
end

```

بخش چهارم)

بخش پنجم)

(1_5

Models

Sort by: Model Number

Model	Type	Accuracy (Validation)	Last change	Features
1	Tree	72.3%	Fine Tree	6/6
2	SVM	77.3%	Linear SVM	6/6

Model 2: SVM
Status: Trained

Training Results

- Accuracy (Validation): 77.3%
- Total cost (Validation): 136
- Prediction speed: ~1500 obs/sec
- Training time: 32.064 sec
- Model size (Compact): ~25 kB

Model Hyperparameters

- Feature Selection: 6/6 individual features selected
- PCA: Disabled
- Misclassification Costs: Default
- Optimizer: Not applicable

دقت گزارش شده 77.3 % است.

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Models

Sort by: Model Number

Model	Type	Accuracy (Validation)	Last change	Features
1	Tree	72.3%	Fine Tree	6/6
2	SVM	77.3%	Linear SVM	6/6
4	SVM	65.3%	Linear SVM	1/6

Model 4: SVM
Status: Trained

Training Results

- Accuracy (Validation): 65.3%
- Total cost (Validation): 208
- Prediction speed: ~20000 obs/sec
- Training time: 1.7678 sec
- Model size (Compact): ~14 kB

Model Hyperparameters

- Feature Selection: 1/6 individual features selected
- PCA: Disabled
- Misclassification Costs: Default
- Optimizer: Not applicable

Glucose:

Models		Model 1	Model 2	Model 4	Model 5	Model 6
Sort by Model Number		Summary × Validation Confusion Matrix ×				
1	Tree	Accuracy (Validation): 72.3%				
Last change: Fine Tree		6/6 features				
2	SVM	Accuracy (Validation): 77.3%				
Last change: Linear SVM		6/6 features				
4	SVM	Accuracy (Validation): 65.3%				
Last change: Linear SVM		1/6 features				
5	SVM	Accuracy (Validation): 65.3%				
Last change: Linear SVM		1/6 features				
6	SVM	Accuracy (Validation): 74.3%				
Last change: Linear SVM		1/6 features				

Model 6: SVM	
Status: Trained	
Training Results	
Accuracy (Validation)	74.3%
Total cost (Validation)	154
Prediction speed	~32000 obs/sec
Training time	9.0708 sec
Model size (Compact)	~12 kB
▶ Model Hyperparameters	
▶ Feature Selection: 1/6 individual features selected	
▶ PCA: Disabled	
▶ Misclassification Costs: Default	
▶ Optimizer: Not applicable	

Skinthicckness:

Models		Model 1	Model 2	Model 4	Model 5	Model 6	Default Feature Selection ×	Model 7
Sort by Model Number		Summary × Validation Confusion Matrix ×						
1	Tree	Accuracy (Validation): 72.3%						
Last change: Fine Tree		6/6 features						
2	SVM	Accuracy (Validation): 77.3%						
Last change: Linear SVM		6/6 features						
4	SVM	Accuracy (Validation): 65.3%						
Last change: Linear SVM		1/6 features						
5	SVM	Accuracy (Validation): 65.3%						
Last change: Linear SVM		1/6 features						
6	SVM	Accuracy (Validation): 74.3%						
Last change: Linear SVM		1/6 features						
7	SVM	Accuracy (Validation): 74.3%						
Last change: Linear SVM		1/6 features						

Model 7: SVM	
Status: Trained	
Training Results	
Accuracy (Validation)	74.3%
Total cost (Validation)	154
Prediction speed	~37000 obs/sec
Training time	9.5754 sec
Model size (Compact)	~12 kB
▶ Model Hyperparameters	
▶ Feature Selection: 1/6 individual features selected	
▶ PCA: Disabled	
▶ Misclassification Costs: Default	
▶ Optimizer: Not applicable	

Models

Model 1Model 2Model 4Model 5Model 6

Sort byModel Number

1 Tree	Accuracy (Validation): 72.3%
Last change: Fine Tree 6/6 features	
2 SVM	Accuracy (Validation): 77.3%
Last change: Linear SVM 6/6 features	
4 SVM	Accuracy (Validation): 65.3%
Last change: Linear SVM 1/6 features	
5 SVM	Accuracy (Validation): 65.3%
Last change: Linear SVM 1/6 features	
6 SVM	Accuracy (Validation): 74.3%
Last change: Linear SVM 1/6 features	
7 SVM	Accuracy (Validation): 74.3%
Last change: Linear SVM 1/6 features	
8 SVM	Accuracy (Validation): 65.3%
Last change: Linear SVM 1/6 features	

Summary ×Validation Confusion Matrix ×

Model 8: SVM

Status: Trained

Training Results

Accuracy (Validation)65.3%

Total cost (Validation)208

Prediction speed~17000 obs/sec

Training time1.9106 sec

Model size (Compact)~14 kB

Model Hyperparameters

Feature Selection: 1/6 individual features selected

PCA: Disabled

Misclassification Costs: Default

Optimizer: Not applicable

Sort by

Model Number

↓

↑

1	Tree	Accuracy (Validation): 72.3%
Last change: Fine Tree		6/6 features
2	SVM	Accuracy (Validation): 77.3%
Last change: Linear SVM		6/6 features
4	SVM	Accuracy (Validation): 65.3%
Last change: Linear SVM		1/6 features
5	SVM	Accuracy (Validation): 65.3%
Last change: Linear SVM		1/6 features
6	SVM	Accuracy (Validation): 74.3%
Last change: Linear SVM		1/6 features
7	SVM	Accuracy (Validation): 74.3%
Last change: Linear SVM		1/6 features
8	SVM	Accuracy (Validation): 65.3%
Last change: Linear SVM		1/6 features
9	SVM	Accuracy (Validation): 65.5%
Last change: Linear SVM		1/6 features

Summary

Validation Confusion Matrix

Model 9: SVM

Status: Trained

Training Results

Accuracy (Validation)

65.5%

Total cost (Validation)

207

Prediction speed

~29000 obs/sec

Training time

7.4586 sec

Model size (Compact)

~14 kB

Model Hyperparameters

Feature Selection: 1/6 individual features selected

PCA: Disabled

Misclassification Costs: Default

Optimizer: Not applicable

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دو ویژگی Skinthicckness , glucose بیشترین تاثیر را داشته اند.

(4_5

Sort by Model Number		Summary x Validation Confusion Matrix x	
1 Tree	Accuracy (Validation): 77.0%	Model 2: SVM Status: Trained Training Results Accuracy (Validation) 79.0% Total cost (Validation) 21 Prediction speed ~2700 obs/sec Training time 3.4812 sec Model size (Compact) ~8 kB » Model Hyperparameters » Feature Selection: 6/6 individual features selected » PCA: Disabled » Misclassification Costs: Default » Optimizer: Not applicable	
Last change: Fine Tree	6/6 features		
2 SVM	Accuracy (Validation): 79.0%		
Last change: Linear SVM	6/6 features		

بله برجسپ دقت تخمین ها با دقت خوبی گزارش شده است و درصد تفاوت آن کمتر از 2 درصد است.