بینایی کامپیوتری

درس ۱۱ب

بازشناسی اشیا در متلب

Object Recognition in MATLAB®

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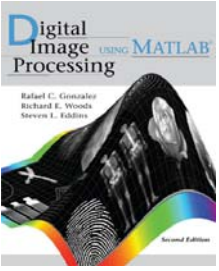
http://courses.fouladi.ir/vision

تطبیق با استفاده از همبستگی

تابع محاسبه‌ی ضریب همبستگی

```
g = normxcorr2(template, f)
```



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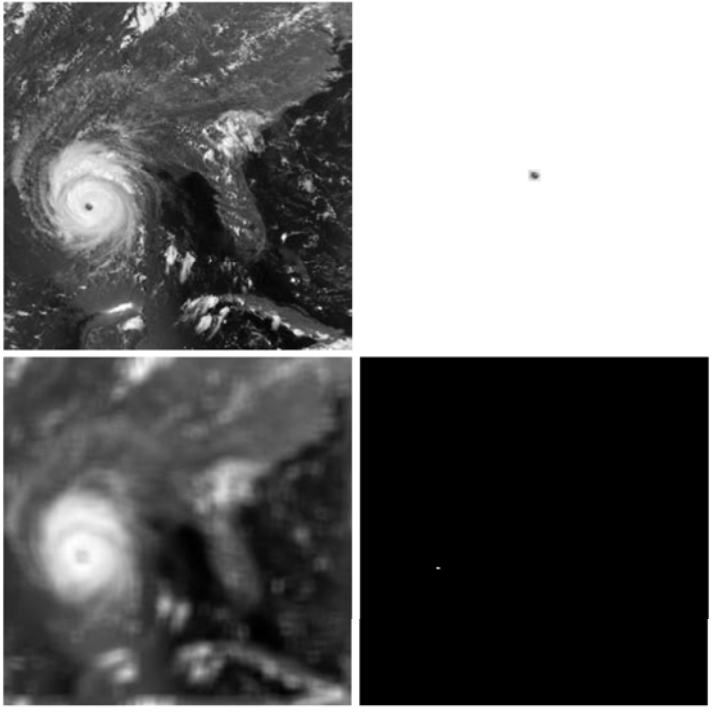
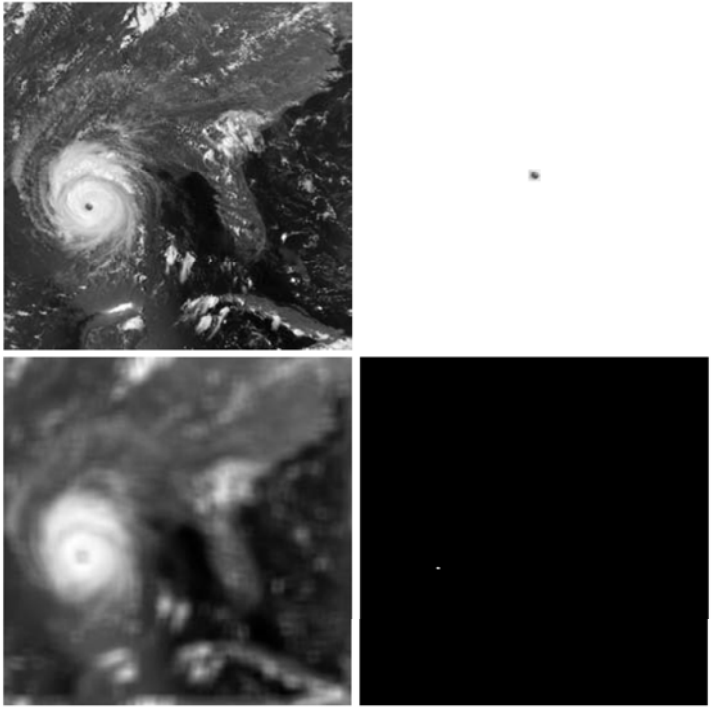


a b
c d

FIGURE 12.1
(a) Multispectral image of Hurricane Andrew.
(b) Template.
(c) Correlation of image and template.
(d) Location of the best match.
(Original image courtesy of NOAA.)

تطبیق با استفاده از همبستگی

مثال



a b
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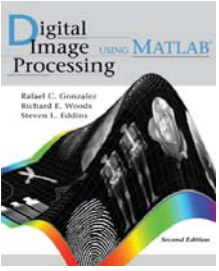

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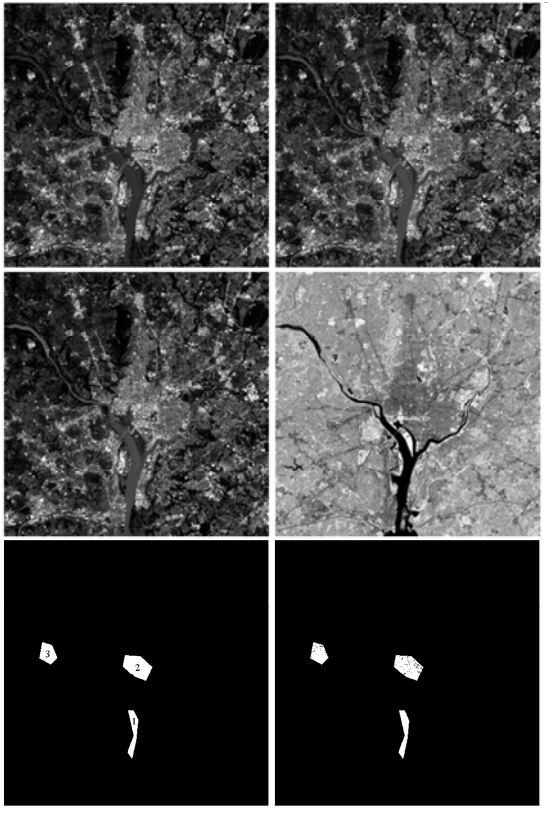
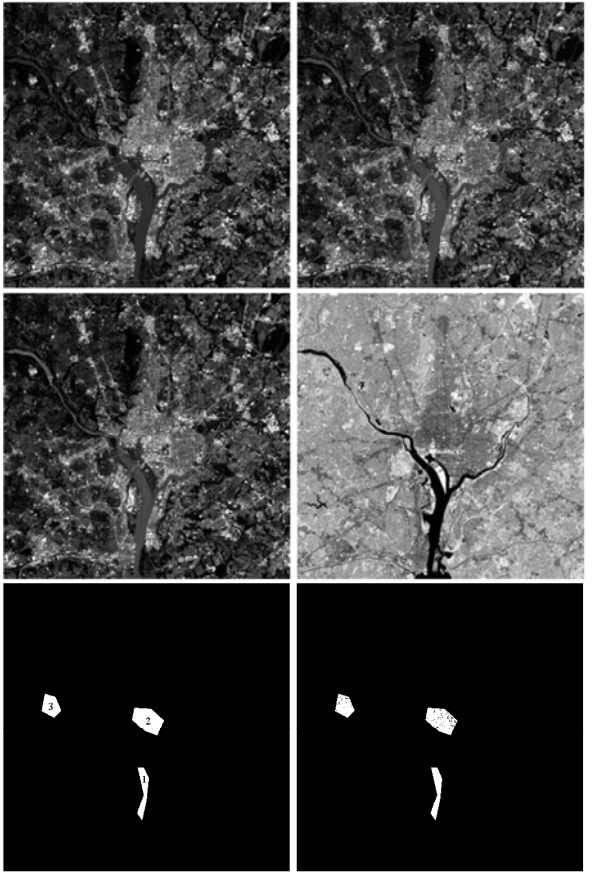


a b
c d
e f

FIGURE 12.2 Bayes classification of multispectral data. (a)–(c) Images in the blue, green, and red visible wavelengths. (d) Infrared image. (e) Mask showing sample regions of water (1), urban development (2), and vegetation (3). (f) Results of classification. The black dots denote points classified incorrectly. The other (white) points in the regions were classified correctly. (Original images courtesy of NASA.)

طبقه‌بندی‌کننده‌های آماری بهینه

مثال (۱ از ۲)



a b
c d
e f

Bayes classification of multispectral data. (a)–(c) Images in the blue, green, and red visible wavelengths. (d) Infrared image. (e) Mask showing sample regions of water (1), urban development (2), and vegetation (3). (f) Results of classification. The black dots denote points classified incorrectly. The other (white) points in the regions were classified correctly.

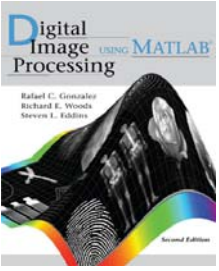


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TABLE 12.1 Bayes classification of multispectral image data.

Training Patterns						Independent Patterns					
Class	No. of Samples	Classified into Class 1	2	3	% Correct	Class	No. of Samples	Classified into Class 1	2	3	% Correct
1	484	482	2	0	99.6	1	483	478	3	2	98.9
2	933	0	885	48	94.9	2	932	0	880	52	94.4
3	483	0	19	464	96.1	3	482	0	16	466	96.7

طبقه‌بندی‌کننده‌های آماری بهینه

مثال (۲ از ۲)

TABLE 12.1 Bayes classification of multispectral image data.

Training Patterns						Independent Patterns					
Class	No. of Samples	Classified into Class 1	2	3	% Correct	Class	No. of Samples	Classified into Class 1	2	3	% Correct
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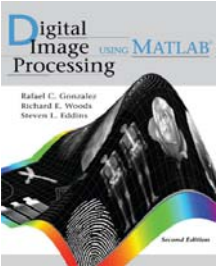
3	483	0	19	464	96.1	3	482	0	16	466	96.7



Category	Function Name	Explanation
General	`blanks`	String of blanks.
	`cellstr`	Create cell array of strings from character array. Use function `char` to convert back to a character string.
	`char`	Create character array (string).
	`deblank`	Remove trailing blanks.
	`eval`	Execute string with MATLAB expression.
String tests	`iscellstr`	True for cell array of strings.
	`ischar`	True for character array.
	`isletter`	True for letters of the alphabet.
	`isspace`	True for whitespace characters.
String operations	`lower`	Convert string to lowercase.
	`regexp`	Match regular expression.
	`regexpi`	Match regular expression, ignoring case.
	`regexprep`	Replace string using regular expression.
	`strcat`	Concatenate strings.
	`strcmp`	Compare strings (see Section 2.10.5).
	`strcmpi`	Compare strings, ignoring case.
	`strfind`	Find one string within another.
	`strjust`	Justify string.
	`strmatch`	Find matches for string.
	`strncmp`	Compare first n characters of strings.
	`strncmpi`	Compare first n characters, ignoring case.
	`strread`	Read formatted data from a string. See Section 2.10.5 for a detailed explanation.
	`strrep`	Replace a string within another.
	`strtok`	Find token in string.
	`strvcat`	Concatenate strings vertically.
	`upper`	Convert string to uppercase.
String to number conversion	`double`	Convert string to numeric codes.
	`int2str`	Convert integer to string.
	`mat2str`	Convert matrix to a string suitable for processing with the `eval` function.
	`num2str`	Convert number to string.
	`sprintf`	Write formatted data to string.
	`str2double`	Convert string to double-precision value.
	`str2num`	Convert string to number (see Section 2.10.5).
	`sscanf`	Read string under format control.
Base number conversion	`base2dec`	Convert base B string to decimal integer.
	`bin2dec`	Convert binary string to decimal integer.
	`dec2base`	Convert decimal integer to base B string.
	`dec2bin`	Convert decimal integer to binary string.
	`dec2hex`	Convert decimal integer to hexadecimal string.
	`hex2dec`	Convert hexadecimal string to decimal integer.
	`hex2num`	Convert IEEE hexadecimal to double-precision number.

TABLE 12.2 MATLAB's string-manipulation functions.

توابع کار با رشته‌ها در متلب

Category	Function Name	Explanation
General	`blanks`	String of blanks.
	`cellstr`	Create cell array of strings from character array. Use function `char` to convert back to a character string.
	`char`	Create character array (string).
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	`strcat`	Concatenate strings.
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توابع کار با رشته‌ها در متلب

	`strncmp`	Compare first n characters of strings.
	`strncmpi`	Compare first n characters, ignoring case.
	`strread`	Read formatted data from a string. See Section 2.10.5 for a detailed explanation.
	`strrep`	Replace a string within another.
	`strtok`	Find token in string.
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	`upper`	Convert string to uppercase.
String to number conversion	`double`	Convert string to numeric codes.
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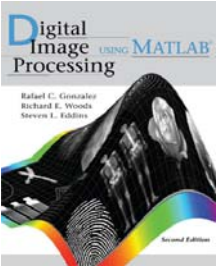

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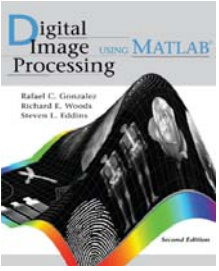
Metacharacters	Usage
`.`	Matches any one character.
`[ab...]`	Matches any one of the characters, (a, b, . . .), contained within the brackets.
`[^ab...]`	Matches any character except those contained within the brackets.
`?`	Matches any character zero or one times.
`*`	Matches the preceding element zero or more times.
`+`	Matches the preceding element one or more times.
`{num}`	Matches the preceding element `num` times.
`{min, max}`	Matches the preceding element at least `min` times, but not more than `max` times.
`|`	Matches either the expression preceding or following the metacharacter `|`.
`^chars`	Matches when a string begins with `chars`.
`chars$`	Matches when a string ends with `chars`.
`\<chars`	Matches when a word begins with chars.
`chars\>`	Matches when a word ends with chars.
`\<word\>`	Exact word match.

TABLE 12.3 Some of the metacharacters used in regular expressions for matching. See the `regular expressions` help page for a complete list.

عبارت‌های منظم در متلب

Metacharacters	Usage
`.`	Matches any one character.
`[ab...]`	Matches any one of the characters, (a, b, . . .), contained within the brackets.
`[^ab...]`	Matches any character except those contained within the brackets.
`?`	Matches any character zero or one times.
`*`	Matches the preceding element zero or more times.
`+`	Matches the preceding element one or more times.
`{num}`	Matches the preceding element `num` times.
`{min, max}`	Matches the preceding element at least `min` times, but not more than `max` times.
`|`	Matches either the expression preceding or following the metacharacter `|`.
`^chars`	Matches when a string begins with `chars`.
`chars$`	Matches when a string ends with `chars`.
`\<chars`	Matches when a word begins with chars.
`chars\>`	Matches when a word ends with chars.
`\<word\>`	Exact word match.

Some of the metacharacters used in regular expressions for matching. See the `regular expressions` help page for a complete list.



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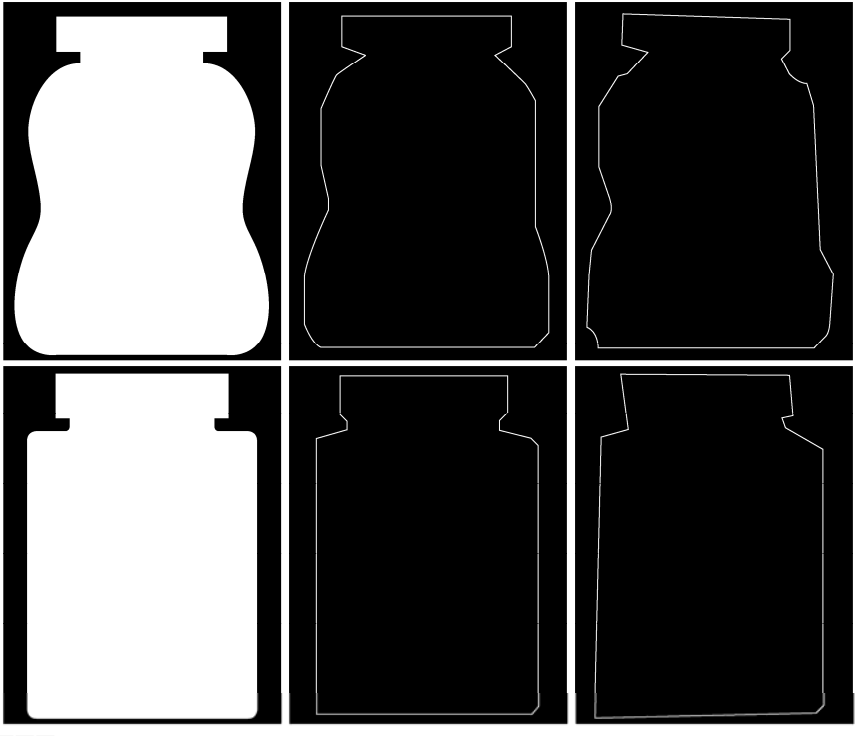
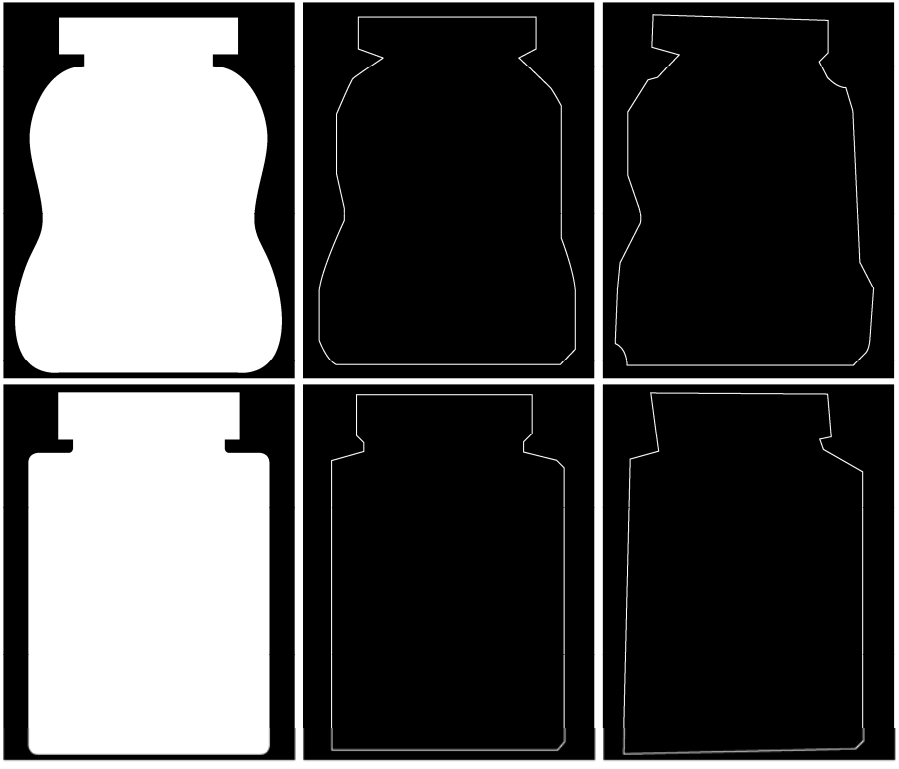


a b c
d e f

FIGURE 12.3 (a) An object. (b) Its minimum perimeter polygon obtained using function `minperpoly` with a cell size of 8. (c) A typical noisy boundary. (d)–(f) The same sequence for another object.

بازشناسی شیئ با تطابق رشته

مثال (۱ از ۲)



a b c
d e f

FIGURE (a) An object. (b) Its minimum perimeter polygon obtained using function `minperpoly` with a cell size of 8. (c) A typical noisy boundary. (d)–(f) The same sequence for another object.

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R	s_{11}	s_{12}	s_{13}	s_{14}	s_{15}
s_{11}	Inf				
s_{12}	9.33	Inf			
s_{13}	26.25	12.31	Inf		
s_{14}	16.36	9.33	14.16	Inf	
s_{15}	22.22	14.17	14.01	19.02	Inf

TABLE 12.4
Values of similarity measure, R, between the strings of class 1. (All values shown are $\times 10$.)

R	s_{21}	s_{22}	s_{23}	s_{24}	s_{25}
s_{21}	Inf				
s_{22}	10.00	Inf			
s_{23}	13.33	13.33	Inf		
s_{24}	7.50	13.31	18.00	Inf	
s_{25}	13.33	7.51	18.12	10.01	Inf

TABLE 12.5
Values of similarity measure, R, between the strings of class 2. (All values shown are $\times 10$.)

R	s_{11}	s_{12}	s_{13}	s_{14}	s_{15}
s_{21}	2.03	0.01	1.15	1.17	0.75
s_{22}	1.15	1.61	1.16	0.75	2.07
s_{23}	2.08	1.15	2.08	2.06	2.08
s_{24}	1.60	1.62	1.59	1.14	2.61
s_{25}	1.61	0.36	0.74	1.60	1.16

TABLE 12.6
Values of similarity measure, R, between the strings of classes 1 and 2. (All values shown are $\times 10$.)

بازشناسی شیئ با تطابق رشته

مثال (۲ از ۲)

R	s_{11}	s_{12}	s_{13}	s_{14}	s_{15}
s_{11}	Inf				
s_{12}	9.33	Inf			
s_{13}	26.25	12.31	Inf		
s_{14}	16.36	9.33	14.16	Inf	
s_{15}	22.22	14.17	14.01	19.02	Inf

Values of similarity measure, R, between the strings of class 1. (All values shown are $\times 10$.)

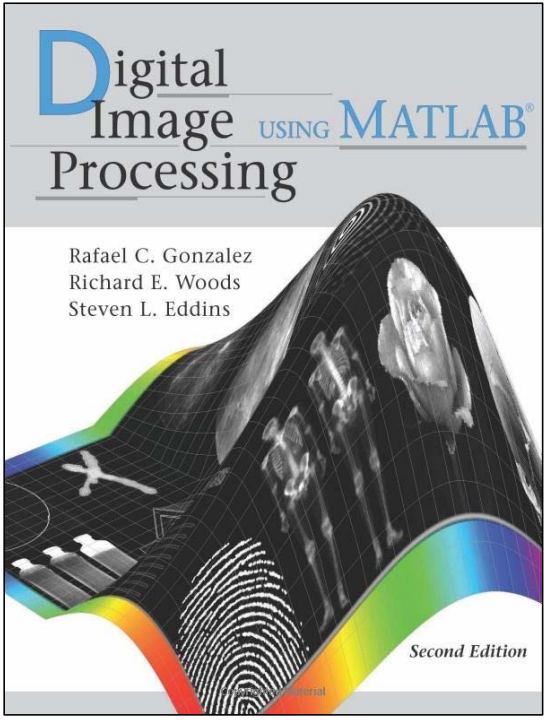
R	s_{21}	s_{22}	s_{23}	s_{24}	s_{25}
s_{21}	Inf				
s_{22}	10.00	Inf			
s_{23}	13.33	13.33	Inf		
s_{24}	7.50	13.31	18.00	Inf	
s_{25}	13.33	7.51	18.12	10.01	Inf

Values of similarity measure, R, between the strings of class 2. (All values shown are $\times 10$.)

R	s_{11}	s_{12}	s_{13}	s_{14}	s_{15}
s_{21}	2.03	0.01	1.15	1.17	0.75
s_{22}	1.15	1.61	1.16	0.75	2.07
s_{23}	2.08	1.15	2.08	2.06	2.08
s_{24}	1.60	1.62	1.59	1.14	2.61
s_{25}	1.61	0.36	0.74	1.60	1.16

Values of similarity measure, R, between the strings of classes 1 and 2. (All values shown are $\times 10$.)

منبع اصلی



Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins,
Digital Image Processing Using MATLAB®,
Second Edition, Pearson Prentice Hall, 2008.
Chapter 13