

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	4	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15		
1	x_5	5 0 3	19		
-1	x_6	1 4 3	27		

Kernel Matrix

$$K(x_i, x'_j)$$

a_i b
 $a_i y_i$
 sign

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i x'_j $L2 \text{ distance } ||^2$ $-y||^2$ $e^{\square}$
 $(x - x')^2$ $\sum \sqrt{(-0.1)}$ $e^{\square}$

$-y ^2$	$e^{\square}$
-0.5	0.6
-0.4	0.67
-0.3	0.7
-0.2	0.8
-0.1	0.9

1	2	1															
0	4	3															
0	3	0															
0	3	1															
5	0	3															
1	4	3															

a_i b
 $a_i y_i$
 sign

Linear

y_i		x_i		3	1	
1	x_1	1	2	1	13	2
-1	x_2	0	4	3	25	7
1	x_3	0	3	0	12	3
-1	x_4	0	3	1	15	4
1	x_5	5	0	3	19	8
-1	x_6	1	4	3	27	8

Kernel Matrix

$$K(x_i, x'_j)$$

a_i	2	0	1	1	1	1	b
$a_i y_i$	2	0	1	-1	-1	2	
							sign
							+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$-y_j ^2$	$e^{\square}$	
		2				1
		4				1
		3				1

x_i		$(x - x')^2$	$\sum \sqrt{-y_j ^2}$	$e^{\square}$
1	2	1		
0	4	3		
0	3	0		
0	3	1		
5	0	3		
1	4	3		

$-y_j ^2$	$e^{\square}$
-0.5	0.6
-0.4	0.67
-0.3	0.7
-0.2	0.8
-0.1	0.9

a_i	20	10	10	10	0	10	b
$a_i y_i$						-1	
							sign

Linear

y_i		x_i		3	1	
1	x_1	1	2	1	13	2
-1	x_2	0	4	3	25	7
1	x_3	0	3	0	12	3
-1	x_4	0	3	1	15	4
1	x_5	5	0	3	19	8
-1	x_6	1	4	3	27	8

 x'_j

SVM

Kernel Matrix

 $K(x_i, x'_j)$

a_i	2	0	1	1	1	1
b						
$a_i y_i$	2	0	1	-1	-1	2
sign	+					+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$-y_j ^2$	$e^{\square}$	
1 2 1	1 4 4	2		-0.5	0.6	1
0 4 3	4 0 0	4		-0.4	0.67	1
0 3 0	0 1 0	3		-0.3	0.7	1
0 3 1	4 1 4			-0.2	0.8	
5 0 3	9 16 0			-0.1	0.9	
1 4 3	1 0 0					

 a_i $a_i y_i$

sign

Linear

y_i		x_i	3	1
1	x_1	1 2 1	13	2
-1	x_2	0 4 3	25	7
1	x_3	0 3 0	12	3
-1	x_4	0 3 1	15	4
1	x_5	5 0 3	19	8
-1	x_6	1 4 3	27	8

 x'_j

SVM

Kernel Matrix

 $K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$-y ^2$	$e^{\square}$	
1 2 1	1 4 4	9		-0.5	0.6	1
0 4 3	4 0 0	4		-0.4	0.67	1
0 3 0	0 1 0	1		-0.3	0.7	1
0 3 1	4 1 4	9		-0.2	0.8	
5 0 3	9 16 0	25		-0.1	0.9	
1 4 3	1 0 0	1				

a_i	20	10	10	10	0	10	b	
$a_i y_i$						-1		
							sign	

Linear

y_i		x_i		3	1	
1	x_1	1	2	1	13	2
-1	x_2	0	4	3	25	7
1	x_3	0	3	0	12	3
-1	x_4	0	3	1	15	4
1	x_5	5	0	3	19	8
-1	x_6	1	4	3	27	8

Kernel Matrix

$$K(x_i, x'_j)$$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2		
							sign	

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$-y ^2$	$e^{\square}$	
1 2 1	1 4 4	9	3	-0.5	0.6	1
0 4 3	4 0 0	4	2	-0.4	0.67	1
0 3 0	0 1 0	1	1	-0.3	0.7	1
0 3 1	4 1 4	9	3	-0.2	0.8	
5 0 3	9 16 0	25	5	-0.1	0.9	
1 4 3	1 0 0	1	1			

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i	x'_j	$L2 \text{ distance } \cdot ^2$	$(x - x')^2$	$\sum \sqrt{-\gamma \cdot ^2}$	$e^{-\gamma \cdot ^2}$	$- \cdot ^2$	$e^{- \cdot ^2}$	
1 2 1	2							1
0 4 3	4							1
0 3 0	3							1
0 3 1								
5 0 3								
1 4 3								

a_i	20	10	10	10	0	10	b	
$a_i y_i$						-1		
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$- x - x' ^2$	$e^{- x - x' ^2}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$						-1		
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	1	-1	2	
								sign
								+

Decision Boundary

$b + \sum a_i y_i K$

RBF

x_i		x'_j		$- x - x' ^2$	$e^{- x - x' ^2}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$							-1	
								sign

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$- x - x' ^2$	$e^{- x - x' ^2}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$						-1		
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$- x - x' ^2$	$e^{- x - x' ^2}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$						-1		
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$- x - x' ^2$	$e^{ x - x' ^2}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$						-1		
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$-y ^2$	$e^{\square}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$						-1		
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

Kernel Matrix

$K(x_i, x'_j)$

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2	→	17
								5
							sign	+

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$-y ^2$	$e^{\square}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$	20	-10	10	-10	0	-10	→	
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2		
							sign	+

Kernel Matrix

$$K(x_i, x'_j)$$

Decision Boundary

$$b + \sum a_i y_i K$$

RBF

x_i		x'_j		$-y ^2$	$e^{\square}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$	20	-10	10	-10	0	-10		
							sign	

Linear

y_i		x_i		x'_1	x'_2
1	x_1	1 2 1	13	2	1
-1	x_2	0 4 3	25	7	1
1	x_3	0 3 0	12	3	1
-1	x_4	0 3 1	15	4	1
1	x_5	5 0 3	19	8	1
-1	x_6	1 4 3	27	8	1

a_i	2	0	1	1	1	1	b	
$a_i y_i$	2	0	1	-1	-1	2		
							→	17
								5
							sign	+

SVM

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Kernel Matrix

$K(x_i, x'_j)$

Decision Boundary

$b + \sum a_i y_i K$

RBF

x_i		x'_j		$- x - x' ^2$	$e^{- x - x' ^2}$	
1 2 1	1 4 4	9	3	-0.3	0.7	1
0 4 3	4 0 0	4	2	-0.2	0.8	1
0 3 0	0 1 0	1	1	-0.1	0.9	1
0 3 1	4 1 4	9	3	-0.3	0.7	
5 0 3	9 16 0	25	5	-0.5	0.6	
1 4 3	1 0 0	1	1	-0.1	0.9	

a_i	20	10	10	10	0	10	b	
$a_i y_i$	20	-10	10	-10	0	-10	→	-2
							sign	-

0 1 0	1	1	-0.1	0.9	
1 9 4	14	3	-0.3	0.7	
1 4 1	6	2	-0.2	0.8	
1 4 0	5	2	-0.2	0.8	
16 1 4	21	4	-0.4	0.67	
0 9 4	13	3	-0.3	0.9	

						→	1
							+