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*(classification)*

*(signal processing)*

*(approximation)*

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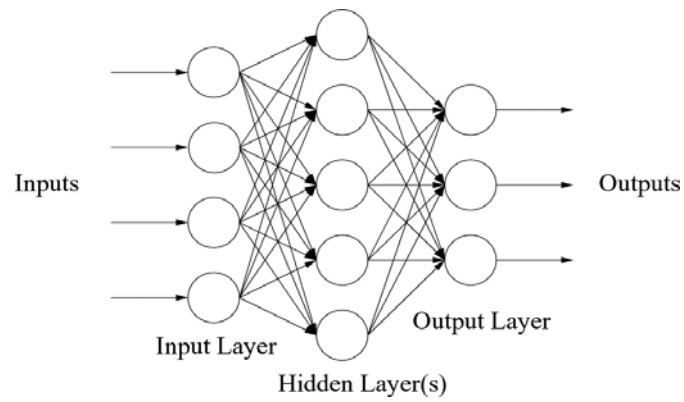
:

...

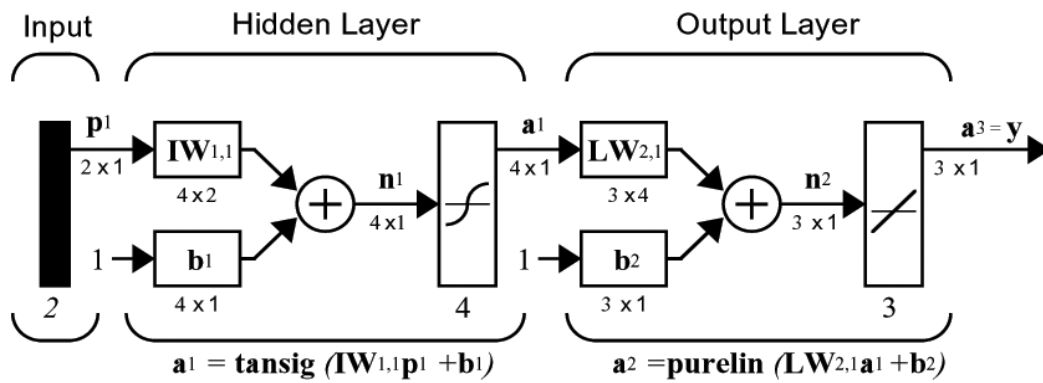
( MLP )  
 ( Multi Layer Perceptron )  
 MLP 1 .

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MLP (Back Propagation)  
 (BP)  
 (Steepest Descent)  
 (Conjugate Gradient)  
 (Levenberg Marquardt)  
 ... SD  
 LM BP CG BP SD BP  
 BP LM CG SD  
 SD

[1]

nntool MATLAB

1987 (Universal Function Approximation)

MLP BP ( [2] ( ) )

(

MLP

)

BP

MLP

UFA

2N+1

N+1

:

N

5

$(L_1,L_2,L_3)=F(\theta,\varphi,h)$

(1 5)

$(\theta,\varphi,h)=F^{-1}(L_1,L_2,L_3)$

(2 5)

$\theta,\varphi,h$

d=138cm    e=30cm

L1,L2,L3

$\theta,\varphi,h$

$L_1=[(a\cos\varphi-b)^2+(a\sin\varphi\sin\theta)^2+(h-a\sin\varphi\cos\theta)^2]^{1/2}$

(3 5)

$L_2=[(-0.5a\cos\varphi+0.5b)^2+(0.866a\cos\theta-0.5a\sin\varphi\sin\theta-0.866b)^2+(0.5a\sin\varphi\cos\theta+0.866a\sin\theta+h)^2]^{1/2}$

( 4 5)

$L_3=[(-0.5a\cos\varphi+0.5b)^2+(-0.866a\cos\theta-0.5a\sin\varphi\sin\theta+0.866b)^2+(0.5a\sin\varphi\cos\theta-0.866a\sin\theta+h)^2]^{1/2}$

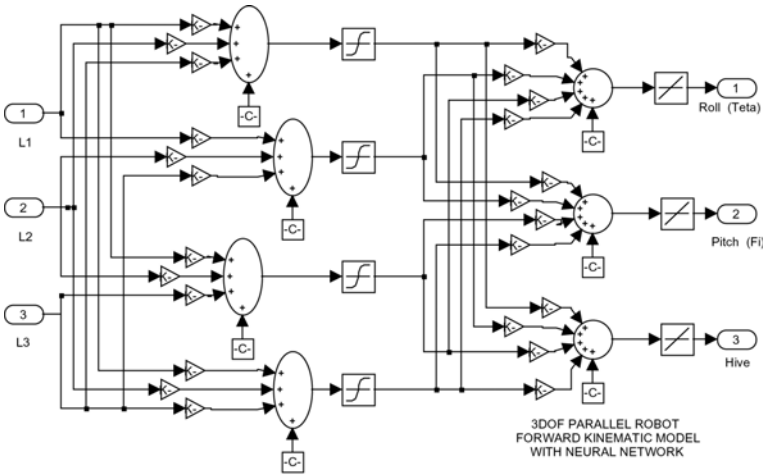
( 5 5)

7 4

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MATLAB

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:5 3

(PURLINE)

(TANSIG)

BP  
MATLAB

nntool

(K)

[1]

(C)

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[3]

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21 1

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$(L_1=105, L_2=101,$

$(\theta=10, \varphi=10, h=90)$   $L_3=90.5)$

2

8

$(\theta, \varphi, h)$

1

$(L1, L2, L3)$

2

( )

( )

وضعیت	$\theta$ (deg.)	$\varphi$ (deg.)	hive (cm)	$\Rightarrow$	L1 (cm)	L2 (cm)	L3 (cm)
حرکت عمودی	0	0	60		72	72	72
	0	0	70		80	80	80
	0	0	80		89	89	89
	0	0	90		98	98	98
	0	0	100		107	107	107
گردش به راست	20	0	80		89	100	80
	15	0	80		89	98	82
	10	0	80		89	95	84
	5	0	80		89	92	86
گردش به چپ	-5	0	80		89	87	92
	-10	0	80		89	84	95
	-15	0	80		89	82	98
	-20	0	80		89	80	101
شیب صعودی	0	20	80		103	84	84
	0	15	80		99	85	85
	0	10	80		96	84	84
	0	5	80		93	88	88
شیب نزولی	0	-5	80		86	91	91
	0	-10	80		83	92	92
	0	-15	80		81	94	94
	0	-20	80		78	96	96
حرکت های ترکیبی	...	...	...		...	...	...

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2. G. Cybenko, “ Approximation by Superposition of a Sigmoidal Function”Mathematics of Control,Signals and System, Vol.2,1989
3. V.Kecman, Learning and Soft Computing,Massachusetts Institute of Technology , p11, 2001.

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L1, L2, L3 ( INPUT FOR KINEMATIC MODEL, NEURAL NETWORK):
W=[72 80 89 98 107 89 89 89 89 89 89 103 99 96 93 86 83 81 78;
72 80 89 98 107 100 98 95 92 87 84 82 80 84 85 86 88 91 92 94 96;
72 80 89 98 107 80 82 84 86 92 95 98 101 84 85 86 88 91 92 94 96]

Teta,Fi,hive ( OUTPUT FROM NEURAL NETWORK KINEMATIC MODEL):
U=[-0.0 0.0 0.0 -0.0 0.0 19.6 15.3 10.3 5.3 -4.7 -10.4 -15.0 -19.5 -0.0 -0.0 -0.0 -0.1 -0.5 -0.1 -0.1 0.2;
-0.1 -0.0 0.0 0.1 -0. -0.4 -0.4 -0.0 0.3 -0.2 -0.0 -0.2 -0.4 19.8 14.8 10.7 5.8 -4.9 -9.9 -14.2 -20.19;
59.9 69.7 80 89.9 99.8 80.0 80.0 79.9 80.0 80.0 79.9 80.0 80.0 79.9 80.0 80.0 79.9 79.9 80.0 80.0]

Teta,Fi,hive ( EXACT VALUE ):
V=[0 0 0 0 0 20 15 10 5 -5 -10 -15 -20 0 0 0 0 0 0 0;
0 0 0 0 0 0 0 0 0 0 0 0 0 20 15 10 5 -5 -10 -15 -20;
60 70 80 90 100 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80]
```