```
a1 = 1;a2= 1;a3= 1;r=0.5;
n=200;x=rand(2,n)*pi-1/2*pi;
nois=rand(1,n)*0.01-0.005;
y=r*tanh([a1 a2]*x+a3)+nois;
a1 = -1;a2= -1;a3= 1;r=-0.5
y=y+r*tanh([a1 a2]*x+a3);
plot3(x(1,:),x(2,:),y,'.');
f=inline('r*tanh(a*x+b)');
xx=x;
aa=[1 1;-1 -1];bb=[1 1];rr=[0.5 -0.5];M=2;
yhat=zeros(1,n);
for i=1:M
yhat=f(aa(i,:),bb(i),rr(i),xx)+yhat;
end
e=yhat-y;
mse=e*e'/length(y)
range=pi; x1=-range:0.1:range; x2=x1;n=length(x1);
for i=1:length(x1)
%C(i,:)=f(aa,bb,rr,[x1(i)*ones(1,n);x2]);
zz=[x1(i)*ones(1,n);x2];
yhat=zeros(1,n);
for m=1:M
yhat=f(aa(m,:),bb(m),rr(m),zz)+yhat;
end
C(i,:)=yhat;
end
mesh(x1,x2,C');
% Initialize Parameters
aa=rand(M,2);rr=rand(1,M);bb=rand(1,M);
% Symbolic Gradients
f=inline('r*tanh(a*x+b)');
r=sym('r');a=sym('a',[1 2]);
b=sym('b');x=sym('x',[2 1])
s=diff(r*tanh(a*x+b),r)
gr=inline(s)
s=diff(r*tanh(a*x+b),a(1))
ga1=inline(s)
s=diff(r*tanh(a*x+b),a(2))
```

```
ga2=inline(s)
s=diff(r*tanh(a*x+b),b)
gb=inline(s)
% gr(a1,a2,b,x1,x2) = tanh(b+a1.*x1+a2.*x2)
% ga1(a1,a2,b,r,x1,x2) = -r.*x1.*(tanh(b
%+a1.*x1+a2.*x2).^2-1.0)
%ga2(a1,a2,b,r,x1,x2) = -r.*x2.*(tanh(b
%+a1.*x1+a2.*x2).^2-1.0)
%gb(a1,a2,b,r,x1,x2) = -r.*(tanh(b
%+a1.*x1+a2.*x2).^2-1.0)
%
%
% Initialization
hc=0;N=length(y);loop=0;ms=[];
step_size=1; loop_max=100;
while ~hc
% Determine mse
%yhat=f(aa,bb,rr,xx);
yhat=zeros(1,N);
for m=1:M
yhat=f(aa(m,:),bb(m),rr(m),xx)+yhat;
end
e=y-yhat; mse=mean(e*e')/length(y)
if mod(loop,2)==0
ms=[ms mse];
end
% Numerical gradients of mse
for m=1:M
mse_a1(m)=-2/N*e*ga1(aa(m,1),aa(m,2),bb(m),rr(m),xx(1,:),xx(2,:))';
mse_a2(m)=-2/N*e*ga2(aa(m,1),aa(m,2),bb(m),rr(m),xx(1,:),xx(2,:))';
mse_b(m)=-2/N*e*gb(aa(m,1),aa(m,2),bb(m),rr(m),xx(1,:),xx(2,:))';
mse_r(m)=-2/N*e*gr(aa(m,1),aa(m,2),bb(m),xx(1,:),xx(2,:))';
end
% Update parameters
for m=1:M
aa(m,2)=aa(m,2)-step_size*mse_a2(m);
aa(m,1)=aa(m,1)-step_size*mse_a1(m);
bb(m)=bb(m)-step_size*mse_b(m);
```

```
rr(m)=rr(m)-step_size*mse_r(m);
end
loop=loop+1;
if loop >loop_max
hc=1;
end
end
figure
plot(1:1:length(ms),ms)
figure
range=pi; x1=-range:0.1:range; x2=x1;n=length(x1);
for i=1:length(x1)
%C(i,:)=f(aa,bb,rr,[x1(i)*ones(1,n);x2]);
zz=[x1(i)*ones(1,n);x2];
yhat=zeros(1,n);
for m=1:M
yhat=f(aa(m,:),bb(m),rr(m),zz)+yhat;
end
C(i,:)=yhat;
end
mesh(x1,x2,C');
```