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```
clear;
clc;
close all;
```

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Read audio file

```
[y,Fs] = audioread('s1.wav');
s=y(:,1); % Extrac 1 channel form audio
s = s - mean(s); % Normalize s
s = s/std(s);
```

Noise

```
n0=randn(size(s));
b=rand(1,5);
a=1;
n=filter(b,a,n0);
disp("please wait until all souds played")

please wait until all souds played
```

Noisy signal

```
x=s+n;
sound(x,Fs)
```

FIR Filter with unit variance noise

N :length of filter M : length of input signal α : μ tilde e : errors w : weights of filter

```
M = length(s);
N =10;

alpha = 1;
[~,e]=NLMS(n0,x,N,alpha,M);
```

```
pause(14)
sound(e,Fs)
```

FIR Filter with a noise of variance 10

```
n0 = sqrt(10).*randn(size(s));
n=filter(b,a,n0);
```

```
pause(14)
x=s+n;
sound(x,Fs)
```

```
[~,e]=NLMS(n0,x,N,alpha,M);
pause(14)
sound(e,Fs)
```

IIR filter

```
a= [1,0.5];
b=[1,-0.9];
```

```
n=filter(b,a,n0);
```

```
x=s+n;
[w,e]=NLMS(n0,x,N,alpha,M);
pause(14)
sound(e,Fs)
```

```
figure(1)
plot(x)
title('noisy signal')
figure(2)
plot(e)
title('out signal');
```

NLMS algorithms

```
function[w,e]=NLMS(inputs,d,N,alpha,M)
% e : error
% u_temp : because LMS run when the first sample arrive, we put M-1 zeros in
begining of inputs, if whe don't put this zeros we must wait to m sample arrive
u_temp=[zeros(1,N-1),inputs'];
e=zeros(1,M);
w=zeros(1,N);
for i=N:M
    u=u_temp(i:-1:i-N+1);
    y=dot(w,u);
    e(i-N+1)=d(i-N+1)-y;
    w = w + (alpha/(norm(u)^2))*e(i-N+1)*u;
end
w=w';
```

end

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