**Lab 5: speech process**

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| **Introduction**  In the lab we learned how to process the speech signal.  In task I, we are told to generate a speech-shaped noise (SSN).  In task II, we tried to add some noise in to the signal.  In task III, we extracted the envelop of the signal.  **Lab results & Analysis**：      This figure shows the power spectral density of the speech signal.    This figure shows the power spectral density of the speech-shaped noise.      We can find in the figure that when increasing the cut off freq, more details are shown in the figure, which means that the signal contained in high frequency domain.    We can see from the figure that when number of order increases, higher frequency signal is filtered.    Code:  %5.1  [y1,fs]=audioread('C\_01\_01.wav');  y1=y1';  sig=repmat(y1,1,10);  N = length(y1);  noise=1-2\*rand(1,N);  [Pxx,w]=pwelch(sig,[],[],512,fs);  figure(1);  plot(w,Pxx);  title('speech signal power spectral density');  xlabel('w speech');  ylabel('Pxx');  saveas(gcf, "1\_1.png");  close;  b=fir2(3000,w/(fs/2),sqrt(Pxx/max(Pxx)));  [h,wh]=freqz(b,1,128);  ssn=filter(b,1,noise);  [Pxx1,w1]=pwelch(ssn,[],[],512,fs);  figure(2);  plot(w1,Pxx1);  title('speech-shaped noise power spectral density');  xlabel('w speech-shaped');  ylabel('Pxx');  saveas(gcf, "1\_2.png");  close;  %5.2  ssn=norm(y1)\*ssn/10^(-5/20)/norm(ssn);  snr=20\*log10(norm(y1)/norm(ssn));  disp(snr);  y=y1+ssn;  y=y\*norm(y1)/norm(y);  %5.3  y=abs(y);  figure(3);  [b,a]=butter(2,100/(fs/2));  envelop3=filter(b,a,y);  subplot(3,1,1);  plot(envelop3);  title('f\_{cut}: 100 Hz');  xlim([0,6000]);  [b,a]=butter(2,200/(fs/2));  envelop2=filter(b,a,y);  subplot(3,1,2);  plot(envelop2);  title('f\_{cut}: 200 Hz');  xlim([0,6000]);  [b,a]=butter(2,300/(fs/2));  envelop3=filter(b,a,y);  subplot(3,1,3);  plot(envelop3);  title('f\_{cut}: 300 Hz');  xlim([0,6000]);  saveas(gcf, "3\_1.png");  close;  figure(4);  [b,a]=butter(2,200/(fs/2));  envelop=filter(b,a,y);  subplot(2,1,1);  plot(envelop);  title('2nd order low-pass filter');  xlim([0,6000]);  [b,a]=butter(6,200/(fs/2));  envelop=filter(b,a,y);  subplot(2,1,2);  plot(envelop);  title('6th order low-pass filter');  xlim([0,6000]);  saveas(gcf, "3\_2.png");  close;  **Note**: Please indicate meaning of the symbols in all expressions. Please indicate the coordinate and unit in all figures. | |
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