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%%Load the speech signal
[y1,Fs]=audioread('arctic_a0001.wav');
sp=y1(:,1);
egg=y1(:,2);
m=resample(sp,16000,Fs);
Fs=16000;
t = 0:1/Fs:(length(m)-1)/Fs;
seg = buffer(m,30*10^(-3)*Fs); %specifying segent length in ms
%%
seg = buffer(m,481,480);
[l,b] = size(seg);
hammingw = 0.5 - 0.5*cos(2*pi*[0:l-1]/(l-1));
hm = repmat(hammingw',1,b);
m_wind = seg.*hm; % frmae multiplied with window
%% Short-time Energy

st_E = sum(m_wind.^2,1);
st_E = st_E / max(st_E);

figure();plot(t,m); hold on;
plot(t,st_E(1:length(m)),'k'); legend('speech signal','short-time energy');

%% Short-time Magnitude

st_M = sum(abs(m_wind),1);
st_M = st_M/max(st_M);

figure();plot(t,m); hold on;
plot(t,st_M(1:length(m)),'k'); legend('speech signal','short-time magnitude');

%%
len=l;
st_ZCR = sum(abs(sign(m_wind(1:end-1,:))-sign(m_wind(2:end,:))),1)/2/len;
st_ZCR = st_ZCR/max(st_ZCR);

figure();plot(t,m); hold on;
plot(t,st_ZCR(1:length(m)),'k'); legend('speech signal','short-time zero-crossing rate');

s=m(4001:4500); %Voiced frmae
%s=m(21011:21500); % unvoiced frame
figure;
subplot(211);plot(s);

% Autocorrelation of the frame
r=xcorr(s);
subplot(212);plot(r);

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%Absolute difference function

%%keep the window overlap less so that computational complexity is reduced.

close all; clear all;clc
[y1,Fs]=audioread('arctic_a0001.wav');
sp=y1(:,1);
egg=y1(:,2);
m=resample(sp,16000,Fs);
Fs=16000;
t = 0:1/Fs:(length(m)-1)/Fs;
seg = buffer(m,30*10^(-3)*Fs);
[l,b] = size(seg);

m_wind = seg; %% assumed as multiplied with rectangular window.

diff_m(l,b) = 0;
for k = 1:l
    for i = 1:b
        diff_m(k,i) = sum(abs(m_wind(:,i)-[zeros(k-1,1);m_wind(1:end-k+1,i)]));
    end
end

%%plotting the absolute difference for one frame (here , 50th frame)

figure;
subplot(211);
plot(m_wind(:,50))
subplot(212);plot(diff_m(:,50))

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