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%-------------------------------------------------------
%Feature extraction for
%MultiModalBioSignalAnalysis MMBSA
%Bachelor Thesis Guillermo Hidalgo Gadea
%Fatigue detection based on multimodal biosignal analysis
%-------------------------------------------------------

%% load Data for Microsleep interval
    fprintf('Loading Microsleep data...\n');
    PATH = 'F:\Processed\Splitted\';

    % search directory for subjects
    files = dir('F:\Processed\Splitted\*_MS.csv');
    files = strvcat(files.name);
    x = size(files);

    % placeholder feature Table
    FeatureTableMS = ones(x(1),96);

    for i = 1:x(1)

        %read .csv file
        FILE = [PATH files(i,:)];
        [a,name,b] = fileparts(FILE);
        fprintf('loading File ...\n');
        fprintf('Filename: %s', name);
        fprintf('\n');
        J = dlmread(FILE);

        %calculate features
        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);

        % average
        FeatureTableMS(i,1) = mean(J(:,2)); %ECG
        FeatureTableMS(i,2) = mean(J(:,3)); %HR
        FeatureTableMS(i,3) = mean(J(:,4)); %HrvHf
        FeatureTableMS(i,4) = mean(J(:,5)); %HrvLf
        FeatureTableMS(i,5) = mean(J(:,6)); %HrvLfHf
        FeatureTableMS(i,6) = mean(J(:,7)); %HrvPnn50
        FeatureTableMS(i,7) = mean(J(:,8)); %HrvRmssd
        FeatureTableMS(i,8) = mean(J(:,9)); %HrvSd1
        FeatureTableMS(i,9) = mean(J(:,10)); %HrvSd2
        FeatureTableMS(i,10) = mean(J(:,11)); %HrvSd2Sd1
        FeatureTableMS(i,11) = mean(J(:,12)); %HrvSdnn
        FeatureTableMS(i,12) = mean(J(:,13)); %HrvSdsd
        FeatureTableMS(i,13) = mean(J(:,17)); %EYELIDOPENING
        FeatureTableMS(i,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER

        % variance
        FeatureTableMS(i,15) = var(J(:,2)); %ECG
        FeatureTableMS(i,16) = var(J(:,17)); %EYELIDOPENING
        FeatureTableMS(i,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER

        % brute force feature extraction
            % means of derivates
            FeatureTableMS(i,18) = mean(diff(J(:,2))); % dECG
            FeatureTableMS(i,19) = mean(diff(J(:,2),2)); % d2ECG
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            FeatureTableMS(i,20) = mean(diff(J(:,17)));  % dEYELIDOPENING
            FeatureTableMS(i,21) = mean(diff(J(:,17),2));  % d2EYELIDOPENING
            FeatureTableMS(i,22) = mean(diff(J(:,21)));  % dFILTEREDPUPILDIAMETER
            FeatureTableMS(i,23) = mean(diff(J(:,21),2));  %↙
d2FILTEREDPUPILDIAMETER

            % skewness of derivates
            FeatureTableMS(i,24) = skewness(diff(J(:,2)));  % dECG
            FeatureTableMS(i,25) = skewness(diff(J(:,2),2));  % d2ECG
            FeatureTableMS(i,26) = skewness(diff(J(:,17)));  % dEYELIDOPENING
            FeatureTableMS(i,27) = skewness(diff(J(:,17),2));  % d2EYELIDOPENING
            FeatureTableMS(i,28) = skewness(diff(J(:,21)));  %↙
dFILTEREDPUPILDIAMETER
            FeatureTableMS(i,29) = skewness(diff(J(:,21),2));  %↙
d2FILTEREDPUPILDIAMETER

            % kurtosis of derivates
            FeatureTableMS(i,30) = kurtosis(diff(J(:,2)));  % dECG
            FeatureTableMS(i,31) = kurtosis(diff(J(:,2),2));  % d2ECG
            FeatureTableMS(i,32) = kurtosis(diff(J(:,17)));  % dEYELIDOPENING
            FeatureTableMS(i,33) = kurtosis(diff(J(:,17),2));  % d2EYELIDOPENING
            FeatureTableMS(i,34) = kurtosis(diff(J(:,21)));  %↙
dFILTEREDPUPILDIAMETER
            FeatureTableMS(i,35) = kurtosis(diff(J(:,21),2));  %↙
d2FILTEREDPUPILDIAMETER

            % min of derivates
            FeatureTableMS(i,36) = min(diff(J(:,2)));  % dECG
            FeatureTableMS(i,37) = min(diff(J(:,2),2));  % d2ECG
            FeatureTableMS(i,38) = min(diff(J(:,17)));  % dEYELIDOPENING
            FeatureTableMS(i,39) = min(diff(J(:,17),2));  % d2EYELIDOPENING
            FeatureTableMS(i,40) = min(diff(J(:,21)));  % dFILTEREDPUPILDIAMETER
            FeatureTableMS(i,41) = min(diff(J(:,21),2));  %↙
d2FILTEREDPUPILDIAMETER

            % max of derivates
            FeatureTableMS(i,42) = max(diff(J(:,2)));  % dECG
            FeatureTableMS(i,43) = max(diff(J(:,2),2));  % d2ECG
            FeatureTableMS(i,44) = max(diff(J(:,17)));  % dEYELIDOPENING
            FeatureTableMS(i,45) = max(diff(J(:,17),2));  % d2EYELIDOPENING
            FeatureTableMS(i,46) = max(diff(J(:,21)));  % dFILTEREDPUPILDIAMETER
            FeatureTableMS(i,47) = max(diff(J(:,21),2));  %↙
d2FILTEREDPUPILDIAMETER

            % means of periodogram power spectral density
            FeatureTableMS(i,48) = mean(periodogram(diff(J(:,2))));  % dECG
            FeatureTableMS(i,49) = mean(periodogram(diff(J(:,2),2)));  % d2ECG
            FeatureTableMS(i,50) = mean(periodogram(diff(J(:,17))));  %↙
dEYELIDOPENING
            FeatureTableMS(i,51) = mean(periodogram(diff(J(:,17),2)));  %↙
d2EYELIDOPENING
            FeatureTableMS(i,52) = mean(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
            FeatureTableMS(i,53) = mean(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER

            % skewness of periodogram power spectral density
            FeatureTableMS(i,54) = skewness(periodogram(diff(J(:,2))));  % dECG
            FeatureTableMS(i,55) = skewness(periodogram(diff(J(:,2),2)));  % d2ECG
            FeatureTableMS(i,56) = skewness(periodogram(diff(J(:,17))));  %↙
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dEYELIDOPENING
 107             FeatureTableMS(i,57) = skewness(periodogram(diff(J(:,17),2)));  %↙
d2EYELIDOPENING
 108             FeatureTableMS(i,58) = skewness(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
 109             FeatureTableMS(i,59) = skewness(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
 110
 111             % kurtosis of periodogram power spectral density
 112             FeatureTableMS(i,60) = kurtosis(periodogram(diff(J(:,2))));  % dECG
 113             FeatureTableMS(i,61) = kurtosis(periodogram(diff(J(:,2),2)));  % d2ECG
 114             FeatureTableMS(i,62) = kurtosis(periodogram(diff(J(:,17))));  %↙
dEYELIDOPENING
 115             FeatureTableMS(i,63) = kurtosis(periodogram(diff(J(:,17),2)));  %↙
d2EYELIDOPENING
 116             FeatureTableMS(i,64) = kurtosis(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
 117             FeatureTableMS(i,65) = kurtosis(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
 118
 119             % min of periodogram power spectral density
 120             FeatureTableMS(i,66) = min(periodogram(diff(J(:,2))));  % dECG
 121             FeatureTableMS(i,67) = min(periodogram(diff(J(:,2),2)));  % d2ECG
 122             FeatureTableMS(i,68) = min(periodogram(diff(J(:,17))));  %↙
dEYELIDOPENING
 123             FeatureTableMS(i,69) = min(periodogram(diff(J(:,17),2)));  %↙
d2EYELIDOPENING
 124             FeatureTableMS(i,70) = min(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
 125             FeatureTableMS(i,71) = min(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
 126
 127             % max of periodogram power spectral density
 128             FeatureTableMS(i,72) = max(periodogram(diff(J(:,2))));  % dECG
 129             FeatureTableMS(i,73) = max(periodogram(diff(J(:,2),2)));  % d2ECG
 130             FeatureTableMS(i,74) = max(periodogram(diff(J(:,17))));  %↙
dEYELIDOPENING
 131             FeatureTableMS(i,75) = max(periodogram(diff(J(:,17),2)));  %↙
d2EYELIDOPENING
 132             FeatureTableMS(i,76) = max(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
 133             FeatureTableMS(i,77) = max(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
 134
 135             % 5 percentile of derivates
 136             FeatureTableMS(i,78) = prctile(diff(J(:,2)),5);  % dECG
 137             FeatureTableMS(i,79) = prctile(diff(J(:,2),2),5);  % d2ECG
 138             FeatureTableMS(i,80) = prctile(diff(J(:,17)),5);  % dEYELIDOPENING
 139             FeatureTableMS(i,81) = prctile(diff(J(:,17),2),5);  % d2EYELIDOPENING
 140             FeatureTableMS(i,82) = prctile(diff(J(:,21)),5);  %↙
dFILTEREDPUPILDIAMETER
 141             FeatureTableMS(i,83) = prctile(diff(J(:,21),2),5);  %↙
d2FILTEREDPUPILDIAMETER
 142
 143             % 25 percentile of derivates
 144             FeatureTableMS(i,84) = prctile(diff(J(:,2)),25);  % dECG
 145             FeatureTableMS(i,85) = prctile(diff(J(:,2),2),25);  % d2ECG
 146             FeatureTableMS(i,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
 147             FeatureTableMS(i,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
 148             FeatureTableMS(i,88) = prctile(diff(J(:,21)),25);  %↙
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dFILTEREDPUPILDIAMETER
 149             FeatureTableMS(i,89) = prctile(diff(J(:,21),2),25);  %↙
d2FILTEREDPUPILDIAMETER
 150
 151             % 75 percentile of derivates
 152             FeatureTableMS(i,90) = prctile(diff(J(:,2)),75);  % dECG
 153             FeatureTableMS(i,91) = prctile(diff(J(:,2),2),75);  % d2ECG
 154             FeatureTableMS(i,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
 155             FeatureTableMS(i,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
 156             FeatureTableMS(i,94) = prctile(diff(J(:,21)),75);  %↙
dFILTEREDPUPILDIAMETER
 157             FeatureTableMS(i,95) = prctile(diff(J(:,21),2),75);  %↙
d2FILTEREDPUPILDIAMETER
 158
 159             % 95 percentile of derivates
 160             FeatureTableMS(i,96) = prctile(diff(J(:,2)),95);  % dECG
 161             FeatureTableMS(i,97) = prctile(diff(J(:,2),2),95);  % d2ECG
 162             FeatureTableMS(i,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
 163             FeatureTableMS(i,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
 164             FeatureTableMS(i,100) = prctile(diff(J(:,21)),95);  %↙
dFILTEREDPUPILDIAMETER
 165             FeatureTableMS(i,101) = prctile(diff(J(:,21),2),95);  %↙
d2FILTEREDPUPILDIAMETER
 166
 167         % label
 168         FeatureTableMS(i,102) = 1;
 169
 170     end
 171
 172     FeatureTable = FeatureTableMS;
 173
 174 %% load Data for non Microsleep interval
 175     fprintf('Loading non Microsleep data...\n');
 176     PATH = 'F:\Processed\Splitted\';
 177
 178     % subjects had different time to microsleep and therefore different
 179     % driving times, resulting in different amount of intervals before MS.
 180     % To standarize the reference non microsleep intervals, the smallest
 181     % needs to be considered (vp029 with 48 intervals)
 182     % Two intervals per subject are selected after 5min driving = mex - 30
 183     % and max - 31. The maximal intervals are listed below
 184
 185   %  'vp003_splitted_264_beforeMS.csv' --> 234, 233
 186   %  'vp008_splitted_435_beforeMS.csv' --> 405, 404
 187   %  'vp017_splitted_256_beforeMS.csv' --> 226, 225
 188   %  'vp020_splitted_333_beforeMS.csv' --> 303, 302
 189   %  'vp023_splitted_331_beforeMS.csv' --> 301, 300
 190   %  'vp024_splitted_484_beforeMS.csv' --> 454, 453
 191   %  'vp028_splitted_762_beforeMS.csv' --> 732, 731
 192   %  'vp029_splitted_48_beforeMS.csv' --> 18, 17
 193   %  'vp030_splitted_314_beforeMS.csv' --> 286, 285
 194   %  'vp031_splitted_123_beforeMS.csv' --> 93, 92
 195   %  'vp032_splitted_237_beforeMS.csv' --> 207, 206
 196
 197
 198     % vp003_234
 199         file = 'F:\Processed\Splitted\vp003_splitted_234_beforeMS.csv';
 200
 201         F = ones(1,102); %adapt size to number of features + label
 202
```

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203         % read .csv file
204         fprintf('loading File ...\n');
205         fprintf('Filename: %s', file(23:40));
206         fprintf('\n');
207         J = dlmread(file);
208 
209         % calculate features
210         % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
211 
212         % average
213         F(1,1) = mean(J(:,2)); %ECG
214         F(1,2) = mean(J(:,3)); %HR
215         F(1,3) = mean(J(:,4)); %HrvHf
216         F(1,4) = mean(J(:,5)); %HrvLf
217         F(1,5) = mean(J(:,6)); %HrvLfHf
218         F(1,6) = mean(J(:,7)); %HrvPnn50
219         F(1,7) = mean(J(:,8)); %HrvRmssd
220         F(1,8) = mean(J(:,9)); %HrvSd1
221         F(1,9) = mean(J(:,10)); %HrvSd2
222         F(1,10) = mean(J(:,11)); %HrvSd2Sd1
223         F(1,11) = mean(J(:,12)); %HrvSdnn
224         F(1,12) = mean(J(:,13)); %HrvSdsd
225         F(1,13) = mean(J(:,17)); %EYELIDOPENING
226         F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
227 
228         % variance
229         F(1,15) = var(J(:,2)); %ECG
230         F(1,16) = var(J(:,17)); %EYELIDOPENING
231         F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
232 
233         % brute force feature extraction
234             % means of derivates
235             F(1,18) = mean(diff(J(:,2))); % dECG
236             F(1,19) = mean(diff(J(:,2),2)); % d2ECG
237             F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
238             F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
239             F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
240             F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
241 
242             % skewness of derivates
243             F(1,24) = skewness(diff(J(:,2))); % dECG
244             F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
245             F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
246             F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
247             F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
248             F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
249 
250             % kurtosis of derivates
251             F(1,30) = kurtosis(diff(J(:,2))); % dECG
252             F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
253             F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
254             F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
255             F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
256             F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
257 
258             % min of derivates
259             F(1,36) = min(diff(J(:,2))); % dECG
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260             F(1,37) = min(diff(J(:,2),2)); % d2ECG
261             F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
262             F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
263             F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
264             F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
265
266             % max of derivates
267             F(1,42) = max(diff(J(:,2))); % dECG
268             F(1,43) = max(diff(J(:,2),2)); % d2ECG
269             F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
270             F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
271             F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
272             F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
273
274             % means of periodogram power spectral density
275             F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
276             F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
277             F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
278             F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
279             F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
280             F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
281
282             % skewness of periodogram power spectral density
283             F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
284             F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
285             F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
286             F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
287             F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
288             F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
289
290             % kurtosis of periodogram power spectral density
291             F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
292             F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
293             F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
294             F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
295             F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
296             F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
297
298             % min of periodogram power spectral density
299             F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
300             F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
301             F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
302             F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
303             F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
304             F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
305
306             % max of periodogram power spectral density
307             F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
308             F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
309             F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
310             F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
311             F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
312             F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
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313
314             % 5 percentile of derivates
315             F(1,78) = prctile(diff(J(:,2)),5); % dECG
316             F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
317             F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
318             F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
319             F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
320             F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
321
322             % 25 percentile of derivates
323             F(1,84) = prctile(diff(J(:,2)),25); % dECG
324             F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
325             F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
326             F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
327             F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
328             F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
329
330             % 75 percentile of derivates
331             F(1,90) = prctile(diff(J(:,2)),75); % dECG
332             F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
333             F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
334             F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
335             F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
336             F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
337
338             % 95 percentile of derivates
339             F(1,96) = prctile(diff(J(:,2)),95); % dECG
340             F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
341             F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
342             F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
343             F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
344             F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
345
346
347         % label
348         F(1,102) = 0;
349
350         FeatureTable = vertcat(FeatureTable, F);
351
352
353     % vp003_233
354         file = 'F:\Processed\Splitted\vp003_splitted_233_beforeMS.csv';
355
356         % read .csv file
357         fprintf('loading File ...\n');
358         fprintf('Filename: %s', file(23:40));
359         fprintf('\n');
360         J = dlmread(file);
361
362         % calculate features
363         % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
364
365         % average
366         F(1,1) = mean(J(:,2)); %ECG
367         F(1,2) = mean(J(:,3)); %HR
368         F(1,3) = mean(J(:,4)); %HrvHf
369         F(1,4) = mean(J(:,5)); %HrvLf
```

```
370         F(1,5) = mean(J(:,6)); %HrvLfHf
371         F(1,6) = mean(J(:,7)); %HrvPnn50
372         F(1,7) = mean(J(:,8)); %HrvRmssd
373         F(1,8) = mean(J(:,9)); %HrvSd1
374         F(1,9) = mean(J(:,10)); %HrvSd2
375         F(1,10) = mean(J(:,11)); %HrvSd2Sd1
376         F(1,11) = mean(J(:,12)); %HrvSdnn
377         F(1,12) = mean(J(:,13)); %HrvSdsd
378         F(1,13) = mean(J(:,17)); %EYELIDOPENING
379         F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
380
381         % variance
382         F(1,15) = var(J(:,2)); %ECG
383         F(1,16) = var(J(:,17)); %EYELIDOPENING
384         F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
385
386         % brute force feature extraction
387             % means of derivates
388             F(1,18) = mean(diff(J(:,2))); % dECG
389             F(1,19) = mean(diff(J(:,2),2)); % d2ECG
390             F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
391             F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
392             F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
393             F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
394
395             % skewness of derivates
396             F(1,24) = skewness(diff(J(:,2))); % dECG
397             F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
398             F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
399             F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
400             F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
401             F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
402
403             % kurtosis of derivates
404             F(1,30) = kurtosis(diff(J(:,2))); % dECG
405             F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
406             F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
407             F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
408             F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
409             F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
410
411             % min of derivates
412             F(1,36) = min(diff(J(:,2))); % dECG
413             F(1,37) = min(diff(J(:,2),2)); % d2ECG
414             F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
415             F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
416             F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
417             F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
418
419             % max of derivates
420             F(1,42) = max(diff(J(:,2))); % dECG
421             F(1,43) = max(diff(J(:,2),2)); % d2ECG
422             F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
423             F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
424             F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
425             F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
426
427             % means of periodogram power spectral density
428             F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
429             F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
```

```
            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % skewness of periodogram power spectral density
            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % kurtosis of periodogram power spectral density
            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % min of periodogram power spectral density
            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % max of periodogram power spectral density
            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % 5 percentile of derivates
            F(1,78) = prctile(diff(J(:,2)),5); % dECG
            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER

            % 25 percentile of derivates
            F(1,84) = prctile(diff(J(:,2)),25); % dECG
            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER

```

```
483             % 75 percentile of derivates
484             F(1,90) = prctile(diff(J(:,2)),75); % dECG
485             F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
486             F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
487             F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
488             F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
489             F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
490
491             % 95 percentile of derivates
492             F(1,96) = prctile(diff(J(:,2)),95); % dECG
493             F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
494             F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
495             F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
496             F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
497             F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
498
499
500         % label
501         F(1,102) = 0;
502
503         FeatureTable = vertcat(FeatureTable, F);
504
505
506   % vp008_405
507         file = 'F:\Processed\Splitted\vp008_splitted_405_beforeMS.csv';
508
509         % read .csv file
510         fprintf('loading File ...\n');
511         fprintf('Filename: %s', file(23:40));
512         fprintf('\n');
513         J = dlmread(file);
514
515         % calculate features
516         % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
517
518         % average
519         F(1,1) = mean(J(:,2)); %ECG
520         F(1,2) = mean(J(:,3)); %HR
521         F(1,3) = mean(J(:,4)); %HrvHf
522         F(1,4) = mean(J(:,5)); %HrvLf
523         F(1,5) = mean(J(:,6)); %HrvLfHf
524         F(1,6) = mean(J(:,7)); %HrvPnn50
525         F(1,7) = mean(J(:,8)); %HrvRmssd
526         F(1,8) = mean(J(:,9)); %HrvSd1
527         F(1,9) = mean(J(:,10)); %HrvSd2
528         F(1,10) = mean(J(:,11)); %HrvSd2Sd1
529         F(1,11) = mean(J(:,12)); %HrvSdnn
530         F(1,12) = mean(J(:,13)); %HrvSdsd
531         F(1,13) = mean(J(:,17)); %EYELIDOPENING
532         F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
533
534         % variance
535         F(1,15) = var(J(:,2)); %ECG
536         F(1,16) = var(J(:,17)); %EYELIDOPENING
537         F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
538
539         % brute force feature extraction
```

```
            % means of derivates
            F(1,18) = mean(diff(J(:,2))); % dECG
            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % skewness of derivates
            F(1,24) = skewness(diff(J(:,2))); % dECG
            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % kurtosis of derivates
            F(1,30) = kurtosis(diff(J(:,2))); % dECG
            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % min of derivates
            F(1,36) = min(diff(J(:,2))); % dECG
            F(1,37) = min(diff(J(:,2),2)); % d2ECG
            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % max of derivates
            F(1,42) = max(diff(J(:,2))); % dECG
            F(1,43) = max(diff(J(:,2),2)); % d2ECG
            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % means of periodogram power spectral density
            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % skewness of periodogram power spectral density
            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % kurtosis of periodogram power spectral density
```

```
            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % min of periodogram power spectral density
            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % max of periodogram power spectral density
            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % 5 percentile of derivates
            F(1,78) = prctile(diff(J(:,2)),5); % dECG
            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER

            % 25 percentile of derivates
            F(1,84) = prctile(diff(J(:,2)),25); % dECG
            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER

            % 75 percentile of derivates
            F(1,90) = prctile(diff(J(:,2)),75); % dECG
            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER

            % 95 percentile of derivates
            F(1,96) = prctile(diff(J(:,2)),95); % dECG
            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER


```

```
653         % label
654         F(1,102) = 0;
655 
656         FeatureTable = vertcat(FeatureTable, F);
657 
658 
659     % vp008_404
660         file = 'F:\Processed\Splitted\vp008_splitted_404_beforeMS.csv';
661 
662         % read .csv file
663         fprintf('loading File ...\n');
664         fprintf('Filename: %s', file(23:40));
665         fprintf('\n');
666         J = dlmread(file);
667 
668         % calculate features
669         % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
670 
671         % average
672         F(1,1) = mean(J(:,2)); %ECG
673         F(1,2) = mean(J(:,3)); %HR
674         F(1,3) = mean(J(:,4)); %HrvHf
675         F(1,4) = mean(J(:,5)); %HrvLf
676         F(1,5) = mean(J(:,6)); %HrvLfHf
677         F(1,6) = mean(J(:,7)); %HrvPnn50
678         F(1,7) = mean(J(:,8)); %HrvRmssd
679         F(1,8) = mean(J(:,9)); %HrvSd1
680         F(1,9) = mean(J(:,10)); %HrvSd2
681         F(1,10) = mean(J(:,11)); %HrvSd2Sd1
682         F(1,11) = mean(J(:,12)); %HrvSdnn
683         F(1,12) = mean(J(:,13)); %HrvSdsd
684         F(1,13) = mean(J(:,17)); %EYELIDOPENING
685         F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
686 
687         % variance
688         F(1,15) = var(J(:,2)); %ECG
689         F(1,16) = var(J(:,17)); %EYELIDOPENING
690         F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
691 
692         % brute force feature extraction
693             % means of derivates
694             F(1,18) = mean(diff(J(:,2))); % dECG
695             F(1,19) = mean(diff(J(:,2),2)); % d2ECG
696             F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
697             F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
698             F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
699             F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
700 
701             % skewness of derivates
702             F(1,24) = skewness(diff(J(:,2))); % dECG
703             F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
704             F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
705             F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
706             F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
707             F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
708 
709             % kurtosis of derivates
```

```
            F(1,30) = kurtosis(diff(J(:,2))); % dECG
            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % min of derivates
            F(1,36) = min(diff(J(:,2))); % dECG
            F(1,37) = min(diff(J(:,2),2)); % d2ECG
            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % max of derivates
            F(1,42) = max(diff(J(:,2))); % dECG
            F(1,43) = max(diff(J(:,2),2)); % d2ECG
            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % means of periodogram power spectral density
            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % skewness of periodogram power spectral density
            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % kurtosis of periodogram power spectral density
            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % min of periodogram power spectral density
            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
```

```
764
765             % max of periodogram power spectral density
766             F(1,72) = max(periodogram(diff(J(:,2))));  % dECG
767             F(1,73) = max(periodogram(diff(J(:,2),2)));  % d2ECG
768             F(1,74) = max(periodogram(diff(J(:,17))));  % dEYELIDOPENING
769             F(1,75) = max(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
770             F(1,76) = max(periodogram(diff(J(:,21))));  % dFILTEREDPUPILDIAMETER
771             F(1,77) = max(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
772
773             % 5 percentile of derivates
774             F(1,78) = prctile(diff(J(:,2)),5);  % dECG
775             F(1,79) = prctile(diff(J(:,2),2),5);  % d2ECG
776             F(1,80) = prctile(diff(J(:,17)),5);  % dEYELIDOPENING
777             F(1,81) = prctile(diff(J(:,17),2),5);  % d2EYELIDOPENING
778             F(1,82) = prctile(diff(J(:,21)),5);  % dFILTEREDPUPILDIAMETER
779             F(1,83) = prctile(diff(J(:,21),2),5);  % d2FILTEREDPUPILDIAMETER
780
781             % 25 percentile of derivates
782             F(1,84) = prctile(diff(J(:,2)),25);  % dECG
783             F(1,85) = prctile(diff(J(:,2),2),25);  % d2ECG
784             F(1,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
785             F(1,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
786             F(1,88) = prctile(diff(J(:,21)),25);  % dFILTEREDPUPILDIAMETER
787             F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
788
789             % 75 percentile of derivates
790             F(1,90) = prctile(diff(J(:,2)),75);  % dECG
791             F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
792             F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
793             F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
794             F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
795             F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
796
797             % 95 percentile of derivates
798             F(1,96) = prctile(diff(J(:,2)),95);  % dECG
799             F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
800             F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
801             F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
802             F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
803             F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
804
805
806         % label
807         F(1,102) = 0;
808
809         FeatureTable = vertcat(FeatureTable, F);
810
811
812   % vp017_226
813         file = 'F:\Processed\Splitted\vp017_splitted_226_beforeMS.csv';
814
815         % read .csv file
816         fprintf('loading File ...\n');
817         fprintf('Filename: %s', file(23:40));
818         fprintf('\n');
819         J = dlmread(file);
820
821         % calculate features
822         % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
```

```
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
 823
 824         % average
 825         F(1,1) = mean(J(:,2)); %ECG
 826         F(1,2) = mean(J(:,3)); %HR
 827         F(1,3) = mean(J(:,4)); %HrvHf
 828         F(1,4) = mean(J(:,5)); %HrvLf
 829         F(1,5) = mean(J(:,6)); %HrvLfHf
 830         F(1,6) = mean(J(:,7)); %HrvPnn50
 831         F(1,7) = mean(J(:,8)); %HrvRmssd
 832         F(1,8) = mean(J(:,9)); %HrvSd1
 833         F(1,9) = mean(J(:,10)); %HrvSd2
 834         F(1,10) = mean(J(:,11)); %HrvSd2Sd1
 835         F(1,11) = mean(J(:,12)); %HrvSdnn
 836         F(1,12) = mean(J(:,13)); %HrvSdsd
 837         F(1,13) = mean(J(:,17)); %EYELIDOPENING
 838         F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
 839
 840         % variance
 841         F(1,15) = var(J(:,2)); %ECG
 842         F(1,16) = var(J(:,17)); %EYELIDOPENING
 843         F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
 844
 845         % brute force feature extraction
 846             % means of derivates
 847             F(1,18) = mean(diff(J(:,2))); % dECG
 848             F(1,19) = mean(diff(J(:,2),2)); % d2ECG
 849             F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
 850             F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
 851             F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
 852             F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
 853
 854             % skewness of derivates
 855             F(1,24) = skewness(diff(J(:,2))); % dECG
 856             F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
 857             F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
 858             F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
 859             F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
 860             F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
 861
 862             % kurtosis of derivates
 863             F(1,30) = kurtosis(diff(J(:,2))); % dECG
 864             F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
 865             F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
 866             F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
 867             F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
 868             F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
 869
 870             % min of derivates
 871             F(1,36) = min(diff(J(:,2))); % dECG
 872             F(1,37) = min(diff(J(:,2),2)); % d2ECG
 873             F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
 874             F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
 875             F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
 876             F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
 877
 878             % max of derivates
 879             F(1,42) = max(diff(J(:,2))); % dECG
```

```
            F(1,43) = max(diff(J(:,2),2)); % d2ECG
            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER

            % means of periodogram power spectral density
            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % skewness of periodogram power spectral density
            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % kurtosis of periodogram power spectral density
            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % min of periodogram power spectral density
            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % max of periodogram power spectral density
            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % 5 percentile of derivates
            F(1,78) = prctile(diff(J(:,2)),5); % dECG
            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
```

```
933
934             % 25 percentile of derivates
935             F(1,84) = prctile(diff(J(:,2)),25); % dECG
936             F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
937             F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
938             F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
939             F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
940             F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
941
942             % 75 percentile of derivates
943             F(1,90) = prctile(diff(J(:,2)),75); % dECG
944             F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
945             F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
946             F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
947             F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
948             F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
949
950             % 95 percentile of derivates
951             F(1,96) = prctile(diff(J(:,2)),95); % dECG
952             F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
953             F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
954             F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
955             F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
956             F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
957
958
959         % label
960         F(1,102) = 0;
961
962         FeatureTable = vertcat(FeatureTable, F);
963
964
965   % vp017_225
966         file = 'F:\Processed\Splitted\vp017_splitted_225_beforeMS.csv';
967
968         % read .csv file
969         fprintf('loading File ...\n');
970         fprintf('Filename: %s', file(23:40));
971         fprintf('\n');
972         J = dlmread(file);
973
974         % calculate features
975         % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
976
977         % average
978         F(1,1) = mean(J(:,2)); %ECG
979         F(1,2) = mean(J(:,3)); %HR
980         F(1,3) = mean(J(:,4)); %HrvHf
981         F(1,4) = mean(J(:,5)); %HrvLf
982         F(1,5) = mean(J(:,6)); %HrvLfHf
983         F(1,6) = mean(J(:,7)); %HrvPnn50
984         F(1,7) = mean(J(:,8)); %HrvRmssd
985         F(1,8) = mean(J(:,9)); %HrvSd1
986         F(1,9) = mean(J(:,10)); %HrvSd2
987         F(1,10) = mean(J(:,11)); %HrvSd2Sd1
988         F(1,11) = mean(J(:,12)); %HrvSdnn
989         F(1,12) = mean(J(:,13)); %HrvSdsd
```

```
 990         F(1,13) = mean(J(:,17)); %EYELIDOPENING
 991         F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
 992
 993         % variance
 994         F(1,15) = var(J(:,2)); %ECG
 995         F(1,16) = var(J(:,17)); %EYELIDOPENING
 996         F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
 997
 998         % brute force feature extraction
 999             % means of derivates
1000             F(1,18) = mean(diff(J(:,2))); % dECG
1001             F(1,19) = mean(diff(J(:,2),2)); % d2ECG
1002             F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
1003             F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
1004             F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1005             F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1006
1007             % skewness of derivates
1008             F(1,24) = skewness(diff(J(:,2))); % dECG
1009             F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
1010             F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
1011             F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
1012             F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1013             F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1014
1015             % kurtosis of derivates
1016             F(1,30) = kurtosis(diff(J(:,2))); % dECG
1017             F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
1018             F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
1019             F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
1020             F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1021             F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1022
1023             % min of derivates
1024             F(1,36) = min(diff(J(:,2))); % dECG
1025             F(1,37) = min(diff(J(:,2),2)); % d2ECG
1026             F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
1027             F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
1028             F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1029             F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1030
1031             % max of derivates
1032             F(1,42) = max(diff(J(:,2))); % dECG
1033             F(1,43) = max(diff(J(:,2),2)); % d2ECG
1034             F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
1035             F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
1036             F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1037             F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1038
1039             % means of periodogram power spectral density
1040             F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
1041             F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
1042             F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1043             F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1044             F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1045             F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1046
1047             % skewness of periodogram power spectral density
1048             F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
```

```
1049            F(1,55) = skewness(periodogram(diff(J(:,2),2)));  % d2ECG
1050            F(1,56) = skewness(periodogram(diff(J(:,17))));  % dEYELIDOPENING
1051            F(1,57) = skewness(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
1052            F(1,58) = skewness(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
1053            F(1,59) = skewness(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
1054
1055            % kurtosis of periodogram power spectral density
1056            F(1,60) = kurtosis(periodogram(diff(J(:,2))));  % dECG
1057            F(1,61) = kurtosis(periodogram(diff(J(:,2),2)));  % d2ECG
1058            F(1,62) = kurtosis(periodogram(diff(J(:,17))));  % dEYELIDOPENING
1059            F(1,63) = kurtosis(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
1060            F(1,64) = kurtosis(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
1061            F(1,65) = kurtosis(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
1062
1063            % min of periodogram power spectral density
1064            F(1,66) = min(periodogram(diff(J(:,2))));  % dECG
1065            F(1,67) = min(periodogram(diff(J(:,2),2)));  % d2ECG
1066            F(1,68) = min(periodogram(diff(J(:,17))));  % dEYELIDOPENING
1067            F(1,69) = min(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
1068            F(1,70) = min(periodogram(diff(J(:,21))));  % dFILTEREDPUPILDIAMETER
1069            F(1,71) = min(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
1070
1071            % max of periodogram power spectral density
1072            F(1,72) = max(periodogram(diff(J(:,2))));  % dECG
1073            F(1,73) = max(periodogram(diff(J(:,2),2)));  % d2ECG
1074            F(1,74) = max(periodogram(diff(J(:,17))));  % dEYELIDOPENING
1075            F(1,75) = max(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
1076            F(1,76) = max(periodogram(diff(J(:,21))));  % dFILTEREDPUPILDIAMETER
1077            F(1,77) = max(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
1078
1079            % 5 percentile of derivates
1080            F(1,78) = prctile(diff(J(:,2)),5);  % dECG
1081            F(1,79) = prctile(diff(J(:,2),2),5);  % d2ECG
1082            F(1,80) = prctile(diff(J(:,17)),5);  % dEYELIDOPENING
1083            F(1,81) = prctile(diff(J(:,17),2),5);  % d2EYELIDOPENING
1084            F(1,82) = prctile(diff(J(:,21)),5);  % dFILTEREDPUPILDIAMETER
1085            F(1,83) = prctile(diff(J(:,21),2),5);  % d2FILTEREDPUPILDIAMETER
1086
1087            % 25 percentile of derivates
1088            F(1,84) = prctile(diff(J(:,2)),25);  % dECG
1089            F(1,85) = prctile(diff(J(:,2),2),25);  % d2ECG
1090            F(1,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
1091            F(1,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
1092            F(1,88) = prctile(diff(J(:,21)),25);  % dFILTEREDPUPILDIAMETER
1093            F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
1094
1095            % 75 percentile of derivates
1096            F(1,90) = prctile(diff(J(:,2)),75);  % dECG
1097            F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
1098            F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
1099            F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
1100            F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
1101            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
1102
```

```
1103            % 95 percentile of derivates
1104            F(1,96) = prctile(diff(J(:,2)),95); % dECG
1105            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
1106            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
1107            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
1108            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
1109            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
1110
1111
1112        % label
1113        F(1,102) = 0;
1114
1115        FeatureTable = vertcat(FeatureTable, F);
1116
1117
1118   % vp020_303
1119        file = 'F:\Processed\Splitted\vp020_splitted_303_beforeMS.csv';
1120
1121        % read .csv file
1122        fprintf('loading File ...\n');
1123        fprintf('Filename: %s', file(23:40));
1124        fprintf('\n');
1125        J = dlmread(file);
1126
1127        % calculate features
1128        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
1129
1130        % average
1131        F(1,1) = mean(J(:,2)); %ECG
1132        F(1,2) = mean(J(:,3)); %HR
1133        F(1,3) = mean(J(:,4)); %HrvHf
1134        F(1,4) = mean(J(:,5)); %HrvLf
1135        F(1,5) = mean(J(:,6)); %HrvLfHf
1136        F(1,6) = mean(J(:,7)); %HrvPnn50
1137        F(1,7) = mean(J(:,8)); %HrvRmssd
1138        F(1,8) = mean(J(:,9)); %HrvSd1
1139        F(1,9) = mean(J(:,10)); %HrvSd2
1140        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
1141        F(1,11) = mean(J(:,12)); %HrvSdnn
1142        F(1,12) = mean(J(:,13)); %HrvSdsd
1143        F(1,13) = mean(J(:,17)); %EYELIDOPENING
1144        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
1145
1146        % variance
1147        F(1,15) = var(J(:,2)); %ECG
1148        F(1,16) = var(J(:,17)); %EYELIDOPENING
1149        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
1150
1151        % brute force feature extraction
1152            % means of derivates
1153            F(1,18) = mean(diff(J(:,2))); % dECG
1154            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
1155            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
1156            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
1157            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1158            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1159
```

```
1160            % skewness of derivates
1161            F(1,24) = skewness(diff(J(:,2))); % dECG
1162            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
1163            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
1164            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
1165            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1166            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1167
1168            % kurtosis of derivates
1169            F(1,30) = kurtosis(diff(J(:,2))); % dECG
1170            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
1171            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
1172            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
1173            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1174            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1175
1176            % min of derivates
1177            F(1,36) = min(diff(J(:,2))); % dECG
1178            F(1,37) = min(diff(J(:,2),2)); % d2ECG
1179            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
1180            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
1181            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1182            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1183
1184            % max of derivates
1185            F(1,42) = max(diff(J(:,2))); % dECG
1186            F(1,43) = max(diff(J(:,2),2)); % d2ECG
1187            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
1188            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
1189            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1190            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1191
1192            % means of periodogram power spectral density
1193            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
1194            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
1195            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1196            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1197            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1198            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1199
1200            % skewness of periodogram power spectral density
1201            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
1202            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
1203            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1204            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1205            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1206            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1207
1208            % kurtosis of periodogram power spectral density
1209            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
1210            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
1211            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1212            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1213            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1214            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
```

```
1215
1216            % min of periodogram power spectral density
1217            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
1218            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
1219            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1220            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1221            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1222            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1223
1224            % max of periodogram power spectral density
1225            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
1226            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
1227            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1228            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1229            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1230            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1231
1232            % 5 percentile of derivates
1233            F(1,78) = prctile(diff(J(:,2)),5); % dECG
1234            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
1235            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
1236            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
1237            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
1238            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
1239
1240            % 25 percentile of derivates
1241            F(1,84) = prctile(diff(J(:,2)),25); % dECG
1242            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
1243            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
1244            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
1245            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
1246            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
1247
1248            % 75 percentile of derivates
1249            F(1,90) = prctile(diff(J(:,2)),75); % dECG
1250            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
1251            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
1252            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
1253            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
1254            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
1255
1256            % 95 percentile of derivates
1257            F(1,96) = prctile(diff(J(:,2)),95); % dECG
1258            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
1259            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
1260            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
1261            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
1262            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
1263
1264
1265        % label
1266        F(1,102) = 0;
1267
1268        FeatureTable = vertcat(FeatureTable, F);
1269
1270
1271   % vp020_302
1272        file = 'F:\Processed\Splitted\vp020_splitted_302_beforeMS.csv';
```

```
1273
1274        % read .csv file
1275        fprintf('loading File ...\n');
1276        fprintf('Filename: %s', file(23:40));
1277        fprintf('\n');
1278        J = dlmread(file);
1279
1280        % calculate features
1281        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
1282
1283        % average
1284        F(1,1) = mean(J(:,2)); %ECG
1285        F(1,2) = mean(J(:,3)); %HR
1286        F(1,3) = mean(J(:,4)); %HrvHf
1287        F(1,4) = mean(J(:,5)); %HrvLf
1288        F(1,5) = mean(J(:,6)); %HrvLfHf
1289        F(1,6) = mean(J(:,7)); %HrvPnn50
1290        F(1,7) = mean(J(:,8)); %HrvRmssd
1291        F(1,8) = mean(J(:,9)); %HrvSd1
1292        F(1,9) = mean(J(:,10)); %HrvSd2
1293        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
1294        F(1,11) = mean(J(:,12)); %HrvSdnn
1295        F(1,12) = mean(J(:,13)); %HrvSdsd
1296        F(1,13) = mean(J(:,17)); %EYELIDOPENING
1297        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
1298
1299        % variance
1300        F(1,15) = var(J(:,2)); %ECG
1301        F(1,16) = var(J(:,17)); %EYELIDOPENING
1302        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
1303
1304        % brute force feature extraction
1305            % means of derivates
1306            F(1,18) = mean(diff(J(:,2))); % dECG
1307            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
1308            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
1309            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
1310            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1311            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1312
1313            % skewness of derivates
1314            F(1,24) = skewness(diff(J(:,2))); % dECG
1315            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
1316            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
1317            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
1318            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1319            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1320
1321            % kurtosis of derivates
1322            F(1,30) = kurtosis(diff(J(:,2))); % dECG
1323            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
1324            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
1325            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
1326            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1327            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1328
1329            % min of derivates
```

```
1330            F(1,36) = min(diff(J(:,2))); % dECG
1331            F(1,37) = min(diff(J(:,2),2)); % d2ECG
1332            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
1333            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
1334            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1335            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1336
1337            % max of derivates
1338            F(1,42) = max(diff(J(:,2))); % dECG
1339            F(1,43) = max(diff(J(:,2),2)); % d2ECG
1340            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
1341            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
1342            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1343            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1344
1345            % means of periodogram power spectral density
1346            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
1347            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
1348            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1349            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1350            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1351            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1352
1353            % skewness of periodogram power spectral density
1354            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
1355            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
1356            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1357            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1358            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1359            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1360
1361            % kurtosis of periodogram power spectral density
1362            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
1363            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
1364            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1365            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1366            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1367            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1368
1369            % min of periodogram power spectral density
1370            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
1371            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
1372            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1373            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1374            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1375            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1376
1377            % max of periodogram power spectral density
1378            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
1379            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
1380            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1381            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1382            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1383            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
```

```
d2FILTEREDPUPILDIAMETER
1384
1385            % 5 percentile of derivates
1386            F(1,78) = prctile(diff(J(:,2)),5); % dECG
1387            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
1388            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
1389            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
1390            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
1391            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
1392
1393            % 25 percentile of derivates
1394            F(1,84) = prctile(diff(J(:,2)),25); % dECG
1395            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
1396            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
1397            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
1398            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
1399            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
1400
1401            % 75 percentile of derivates
1402            F(1,90) = prctile(diff(J(:,2)),75); % dECG
1403            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
1404            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
1405            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
1406            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
1407            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
1408
1409            % 95 percentile of derivates
1410            F(1,96) = prctile(diff(J(:,2)),95); % dECG
1411            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
1412            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
1413            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
1414            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
1415            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
1416
1417
1418        % label
1419        F(1,102) = 0;
1420
1421        FeatureTable = vertcat(FeatureTable, F);
1422
1423
1424   % vp023_301
1425        file = 'F:\Processed\Splitted\vp023_splitted_301_beforeMS.csv';
1426
1427        % read .csv file
1428        fprintf('loading File ...\n');
1429        fprintf('Filename: %s', file(23:40));
1430        fprintf('\n');
1431        J = dlmread(file);
1432
1433        % calculate features
1434        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
1435
1436        % average
1437        F(1,1) = mean(J(:,2)); %ECG
1438        F(1,2) = mean(J(:,3)); %HR
1439        F(1,3) = mean(J(:,4)); %HrvHf
```

```
1440        F(1,4) = mean(J(:,5)); %HrvLf
1441        F(1,5) = mean(J(:,6)); %HrvLfHf
1442        F(1,6) = mean(J(:,7)); %HrvPnn50
1443        F(1,7) = mean(J(:,8)); %HrvRmssd
1444        F(1,8) = mean(J(:,9)); %HrvSd1
1445        F(1,9) = mean(J(:,10)); %HrvSd2
1446        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
1447        F(1,11) = mean(J(:,12)); %HrvSdnn
1448        F(1,12) = mean(J(:,13)); %HrvSdsd
1449        F(1,13) = mean(J(:,17)); %EYELIDOPENING
1450        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
1451
1452        % variance
1453        F(1,15) = var(J(:,2)); %ECG
1454        F(1,16) = var(J(:,17)); %EYELIDOPENING
1455        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
1456
1457        % brute force feature extraction
1458            % means of derivates
1459            F(1,18) = mean(diff(J(:,2))); % dECG
1460            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
1461            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
1462            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
1463            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1464            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1465
1466            % skewness of derivates
1467            F(1,24) = skewness(diff(J(:,2))); % dECG
1468            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
1469            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
1470            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
1471            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1472            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1473
1474            % kurtosis of derivates
1475            F(1,30) = kurtosis(diff(J(:,2))); % dECG
1476            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
1477            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
1478            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
1479            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1480            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1481
1482            % min of derivates
1483            F(1,36) = min(diff(J(:,2))); % dECG
1484            F(1,37) = min(diff(J(:,2),2)); % d2ECG
1485            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
1486            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
1487            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1488            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1489
1490            % max of derivates
1491            F(1,42) = max(diff(J(:,2))); % dECG
1492            F(1,43) = max(diff(J(:,2),2)); % d2ECG
1493            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
1494            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
1495            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1496            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1497
1498            % means of periodogram power spectral density
1499            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
```

```
            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % skewness of periodogram power spectral density
            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % kurtosis of periodogram power spectral density
            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % min of periodogram power spectral density
            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % max of periodogram power spectral density
            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % 5 percentile of derivates
            F(1,78) = prctile(diff(J(:,2)),5); % dECG
            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER

            % 25 percentile of derivates
            F(1,84) = prctile(diff(J(:,2)),25); % dECG
            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
```

```
1553
1554            % 75 percentile of derivates
1555            F(1,90) = prctile(diff(J(:,2)),75); % dECG
1556            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
1557            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
1558            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
1559            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
1560            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
1561
1562            % 95 percentile of derivates
1563            F(1,96) = prctile(diff(J(:,2)),95); % dECG
1564            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
1565            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
1566            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
1567            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
1568            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
1569
1570
1571        % label
1572        F(1,102) = 0;
1573
1574        FeatureTable = vertcat(FeatureTable, F);
1575
1576
1577   % vp023_300
1578        file = 'F:\Processed\Splitted\vp023_splitted_300_beforeMS.csv';
1579
1580        % read .csv file
1581        fprintf('loading File ...\n');
1582        fprintf('Filename: %s', file(23:40));
1583        fprintf('\n');
1584        J = dlmread(file);
1585
1586        % calculate features
1587        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
1588
1589        % average
1590        F(1,1) = mean(J(:,2)); %ECG
1591        F(1,2) = mean(J(:,3)); %HR
1592        F(1,3) = mean(J(:,4)); %HrvHf
1593        F(1,4) = mean(J(:,5)); %HrvLf
1594        F(1,5) = mean(J(:,6)); %HrvLfHf
1595        F(1,6) = mean(J(:,7)); %HrvPnn50
1596        F(1,7) = mean(J(:,8)); %HrvRmssd
1597        F(1,8) = mean(J(:,9)); %HrvSd1
1598        F(1,9) = mean(J(:,10)); %HrvSd2
1599        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
1600        F(1,11) = mean(J(:,12)); %HrvSdnn
1601        F(1,12) = mean(J(:,13)); %HrvSdsd
1602        F(1,13) = mean(J(:,17)); %EYELIDOPENING
1603        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
1604
1605        % variance
1606        F(1,15) = var(J(:,2)); %ECG
1607        F(1,16) = var(J(:,17)); %EYELIDOPENING
1608        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
1609
```

```
1610        % brute force feature extraction
1611            % means of derivates
1612            F(1,18) = mean(diff(J(:,2))); % dECG
1613            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
1614            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
1615            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
1616            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1617            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1618
1619            % skewness of derivates
1620            F(1,24) = skewness(diff(J(:,2))); % dECG
1621            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
1622            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
1623            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
1624            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1625            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1626
1627            % kurtosis of derivates
1628            F(1,30) = kurtosis(diff(J(:,2))); % dECG
1629            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
1630            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
1631            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
1632            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1633            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1634
1635            % min of derivates
1636            F(1,36) = min(diff(J(:,2))); % dECG
1637            F(1,37) = min(diff(J(:,2),2)); % d2ECG
1638            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
1639            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
1640            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1641            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1642
1643            % max of derivates
1644            F(1,42) = max(diff(J(:,2))); % dECG
1645            F(1,43) = max(diff(J(:,2),2)); % d2ECG
1646            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
1647            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
1648            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1649            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1650
1651            % means of periodogram power spectral density
1652            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
1653            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
1654            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1655            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1656            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1657            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1658
1659            % skewness of periodogram power spectral density
1660            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
1661            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
1662            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1663            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1664            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1665            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1666
```

```
1667            % kurtosis of periodogram power spectral density
1668            F(1,60) = kurtosis(periodogram(diff(J(:,2))));  % dECG
1669            F(1,61) = kurtosis(periodogram(diff(J(:,2),2)));  % d2ECG
1670            F(1,62) = kurtosis(periodogram(diff(J(:,17))));  % dEYELIDOPENING
1671            F(1,63) = kurtosis(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
1672            F(1,64) = kurtosis(periodogram(diff(J(:,21))));  %↙
dFILTEREDPUPILDIAMETER
1673            F(1,65) = kurtosis(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
1674
1675            % min of periodogram power spectral density
1676            F(1,66) = min(periodogram(diff(J(:,2))));  % dECG
1677            F(1,67) = min(periodogram(diff(J(:,2),2)));  % d2ECG
1678            F(1,68) = min(periodogram(diff(J(:,17))));  % dEYELIDOPENING
1679            F(1,69) = min(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
1680            F(1,70) = min(periodogram(diff(J(:,21))));  % dFILTEREDPUPILDIAMETER
1681            F(1,71) = min(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
1682
1683            % max of periodogram power spectral density
1684            F(1,72) = max(periodogram(diff(J(:,2))));  % dECG
1685            F(1,73) = max(periodogram(diff(J(:,2),2)));  % d2ECG
1686            F(1,74) = max(periodogram(diff(J(:,17))));  % dEYELIDOPENING
1687            F(1,75) = max(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
1688            F(1,76) = max(periodogram(diff(J(:,21))));  % dFILTEREDPUPILDIAMETER
1689            F(1,77) = max(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
1690
1691            % 5 percentile of derivates
1692            F(1,78) = prctile(diff(J(:,2)),5);  % dECG
1693            F(1,79) = prctile(diff(J(:,2),2),5);  % d2ECG
1694            F(1,80) = prctile(diff(J(:,17)),5);  % dEYELIDOPENING
1695            F(1,81) = prctile(diff(J(:,17),2),5);  % d2EYELIDOPENING
1696            F(1,82) = prctile(diff(J(:,21)),5);  % dFILTEREDPUPILDIAMETER
1697            F(1,83) = prctile(diff(J(:,21),2),5);  % d2FILTEREDPUPILDIAMETER
1698
1699            % 25 percentile of derivates
1700            F(1,84) = prctile(diff(J(:,2)),25);  % dECG
1701            F(1,85) = prctile(diff(J(:,2),2),25);  % d2ECG
1702            F(1,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
1703            F(1,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
1704            F(1,88) = prctile(diff(J(:,21)),25);  % dFILTEREDPUPILDIAMETER
1705            F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
1706
1707            % 75 percentile of derivates
1708            F(1,90) = prctile(diff(J(:,2)),75);  % dECG
1709            F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
1710            F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
1711            F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
1712            F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
1713            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
1714
1715            % 95 percentile of derivates
1716            F(1,96) = prctile(diff(J(:,2)),95);  % dECG
1717            F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
1718            F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
1719            F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
1720            F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
1721            F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
1722
```

```
1723
1724        % label
1725        F(1,102) = 0;
1726
1727        FeatureTable = vertcat(FeatureTable, F);
1728
1729
1730    % vp024_454
1731        file = 'F:\Processed\Splitted\vp024_splitted_454_beforeMS.csv';
1732
1733        % read .csv file
1734        fprintf('loading File ...\n');
1735        fprintf('Filename: %s', file(23:40));
1736        fprintf('\n');
1737        J = dlmread(file);
1738
1739        % calculate features
1740        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
1741
1742        % average
1743        F(1,1) = mean(J(:,2)); %ECG
1744        F(1,2) = mean(J(:,3)); %HR
1745        F(1,3) = mean(J(:,4)); %HrvHf
1746        F(1,4) = mean(J(:,5)); %HrvLf
1747        F(1,5) = mean(J(:,6)); %HrvLfHf
1748        F(1,6) = mean(J(:,7)); %HrvPnn50
1749        F(1,7) = mean(J(:,8)); %HrvRmssd
1750        F(1,8) = mean(J(:,9)); %HrvSd1
1751        F(1,9) = mean(J(:,10)); %HrvSd2
1752        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
1753        F(1,11) = mean(J(:,12)); %HrvSdnn
1754        F(1,12) = mean(J(:,13)); %HrvSdsd
1755        F(1,13) = mean(J(:,17)); %EYELIDOPENING
1756        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
1757
1758        % variance
1759        F(1,15) = var(J(:,2)); %ECG
1760        F(1,16) = var(J(:,17)); %EYELIDOPENING
1761        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
1762
1763        % brute force feature extraction
1764            % means of derivates
1765            F(1,18) = mean(diff(J(:,2))); % dECG
1766            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
1767            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
1768            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
1769            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1770            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1771
1772            % skewness of derivates
1773            F(1,24) = skewness(diff(J(:,2))); % dECG
1774            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
1775            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
1776            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
1777            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1778            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1779
```

```
1780            % kurtosis of derivates
1781            F(1,30) = kurtosis(diff(J(:,2))); % dECG
1782            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
1783            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
1784            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
1785            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1786            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1787
1788            % min of derivates
1789            F(1,36) = min(diff(J(:,2))); % dECG
1790            F(1,37) = min(diff(J(:,2),2)); % d2ECG
1791            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
1792            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
1793            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1794            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1795
1796            % max of derivates
1797            F(1,42) = max(diff(J(:,2))); % dECG
1798            F(1,43) = max(diff(J(:,2),2)); % d2ECG
1799            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
1800            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
1801            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1802            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1803
1804            % means of periodogram power spectral density
1805            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
1806            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
1807            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1808            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1809            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1810            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1811
1812            % skewness of periodogram power spectral density
1813            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
1814            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
1815            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1816            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1817            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1818            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1819
1820            % kurtosis of periodogram power spectral density
1821            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
1822            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
1823            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1824            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1825            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1826            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1827
1828            % min of periodogram power spectral density
1829            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
1830            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
1831            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1832            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1833            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1834            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
```

```
d2FILTEREDPUPILDIAMETER
1835
1836            % max of periodogram power spectral density
1837            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
1838            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
1839            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1840            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1841            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1842            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1843
1844            % 5 percentile of derivates
1845            F(1,78) = prctile(diff(J(:,2)),5); % dECG
1846            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
1847            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
1848            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
1849            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
1850            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
1851
1852            % 25 percentile of derivates
1853            F(1,84) = prctile(diff(J(:,2)),25); % dECG
1854            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
1855            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
1856            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
1857            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
1858            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
1859
1860            % 75 percentile of derivates
1861            F(1,90) = prctile(diff(J(:,2)),75); % dECG
1862            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
1863            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
1864            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
1865            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
1866            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
1867
1868            % 95 percentile of derivates
1869            F(1,96) = prctile(diff(J(:,2)),95); % dECG
1870            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
1871            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
1872            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
1873            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
1874            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
1875
1876
1877        % label
1878        F(1,102) = 0;
1879
1880        FeatureTable = vertcat(FeatureTable, F);
1881
1882
1883   % vp024_453
1884        file = 'F:\Processed\Splitted\vp024_splitted_453_beforeMS.csv';
1885
1886        % read .csv file
1887        fprintf('loading File ...\n');
1888        fprintf('Filename: %s', file(23:40));
1889        fprintf('\n');
1890        J = dlmread(file);
1891
1892        % calculate features
```

```
1893        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
1894
1895        % average
1896        F(1,1) = mean(J(:,2)); %ECG
1897        F(1,2) = mean(J(:,3)); %HR
1898        F(1,3) = mean(J(:,4)); %HrvHf
1899        F(1,4) = mean(J(:,5)); %HrvLf
1900        F(1,5) = mean(J(:,6)); %HrvLfHf
1901        F(1,6) = mean(J(:,7)); %HrvPnn50
1902        F(1,7) = mean(J(:,8)); %HrvRmssd
1903        F(1,8) = mean(J(:,9)); %HrvSd1
1904        F(1,9) = mean(J(:,10)); %HrvSd2
1905        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
1906        F(1,11) = mean(J(:,12)); %HrvSdnn
1907        F(1,12) = mean(J(:,13)); %HrvSdsd
1908        F(1,13) = mean(J(:,17)); %EYELIDOPENING
1909        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
1910
1911        % variance
1912        F(1,15) = var(J(:,2)); %ECG
1913        F(1,16) = var(J(:,17)); %EYELIDOPENING
1914        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
1915
1916        % brute force feature extraction
1917            % means of derivates
1918            F(1,18) = mean(diff(J(:,2))); % dECG
1919            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
1920            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
1921            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
1922            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1923            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1924
1925            % skewness of derivates
1926            F(1,24) = skewness(diff(J(:,2))); % dECG
1927            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
1928            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
1929            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
1930            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1931            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1932
1933            % kurtosis of derivates
1934            F(1,30) = kurtosis(diff(J(:,2))); % dECG
1935            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
1936            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
1937            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
1938            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1939            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1940
1941            % min of derivates
1942            F(1,36) = min(diff(J(:,2))); % dECG
1943            F(1,37) = min(diff(J(:,2),2)); % d2ECG
1944            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
1945            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
1946            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1947            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1948
1949            % max of derivates
```

```
1950            F(1,42) = max(diff(J(:,2))); % dECG
1951            F(1,43) = max(diff(J(:,2),2)); % d2ECG
1952            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
1953            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
1954            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
1955            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
1956
1957            % means of periodogram power spectral density
1958            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
1959            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
1960            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1961            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1962            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1963            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1964
1965            % skewness of periodogram power spectral density
1966            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
1967            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
1968            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1969            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1970            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1971            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1972
1973            % kurtosis of periodogram power spectral density
1974            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
1975            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
1976            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1977            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1978            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
1979            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1980
1981            % min of periodogram power spectral density
1982            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
1983            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
1984            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1985            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1986            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1987            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1988
1989            % max of periodogram power spectral density
1990            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
1991            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
1992            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
1993            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
1994            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
1995            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
1996
1997            % 5 percentile of derivates
1998            F(1,78) = prctile(diff(J(:,2)),5); % dECG
1999            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
2000            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
2001            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
2002            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
```

```
2003            F(1,83) = prctile(diff(J(:,21),2),5);  % d2FILTEREDPUPILDIAMETER
2004
2005            % 25 percentile of derivates
2006            F(1,84) = prctile(diff(J(:,2)),25);  % dECG
2007            F(1,85) = prctile(diff(J(:,2),2),25);  % d2ECG
2008            F(1,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
2009            F(1,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
2010            F(1,88) = prctile(diff(J(:,21)),25);  % dFILTEREDPUPILDIAMETER
2011            F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
2012
2013            % 75 percentile of derivates
2014            F(1,90) = prctile(diff(J(:,2)),75);  % dECG
2015            F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
2016            F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
2017            F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
2018            F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
2019            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
2020
2021            % 95 percentile of derivates
2022            F(1,96) = prctile(diff(J(:,2)),95);  % dECG
2023            F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
2024            F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
2025            F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
2026            F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
2027            F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
2028
2029
2030        % label
2031        F(1,102) = 0;
2032
2033        FeatureTable = vertcat(FeatureTable, F);
2034
2035
2036   % vp028_732
2037        file = 'F:\Processed\Splitted\vp028_splitted_732_beforeMS.csv';
2038
2039        % read .csv file
2040        fprintf('loading File ...\n');
2041        fprintf('Filename: %s', file(23:40));
2042        fprintf('\n');
2043        J = dlmread(file);
2044
2045        % calculate features
2046        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
2047
2048        % average
2049        F(1,1) = mean(J(:,2));  %ECG
2050        F(1,2) = mean(J(:,3));  %HR
2051        F(1,3) = mean(J(:,4));  %HrvHf
2052        F(1,4) = mean(J(:,5));  %HrvLf
2053        F(1,5) = mean(J(:,6));  %HrvLfHf
2054        F(1,6) = mean(J(:,7));  %HrvPnn50
2055        F(1,7) = mean(J(:,8));  %HrvRmssd
2056        F(1,8) = mean(J(:,9));  %HrvSd1
2057        F(1,9) = mean(J(:,10));  %HrvSd2
2058        F(1,10) = mean(J(:,11));  %HrvSd2Sd1
2059        F(1,11) = mean(J(:,12));  %HrvSdnn
```

```
2060        F(1,12) = mean(J(:,13)); %HrvSdsd
2061        F(1,13) = mean(J(:,17)); %EYELIDOPENING
2062        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
2063
2064        % variance
2065        F(1,15) = var(J(:,2)); %ECG
2066        F(1,16) = var(J(:,17)); %EYELIDOPENING
2067        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
2068
2069        % brute force feature extraction
2070            % means of derivates
2071            F(1,18) = mean(diff(J(:,2))); % dECG
2072            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
2073            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
2074            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
2075            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2076            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2077
2078            % skewness of derivates
2079            F(1,24) = skewness(diff(J(:,2))); % dECG
2080            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
2081            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
2082            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
2083            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2084            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2085
2086            % kurtosis of derivates
2087            F(1,30) = kurtosis(diff(J(:,2))); % dECG
2088            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
2089            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
2090            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
2091            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2092            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2093
2094            % min of derivates
2095            F(1,36) = min(diff(J(:,2))); % dECG
2096            F(1,37) = min(diff(J(:,2),2)); % d2ECG
2097            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
2098            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
2099            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2100            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2101
2102            % max of derivates
2103            F(1,42) = max(diff(J(:,2))); % dECG
2104            F(1,43) = max(diff(J(:,2),2)); % d2ECG
2105            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
2106            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
2107            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2108            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2109
2110            % means of periodogram power spectral density
2111            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
2112            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
2113            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2114            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2115            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2116            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2117
2118            % skewness of periodogram power spectral density
```

```
            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % kurtosis of periodogram power spectral density
            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % min of periodogram power spectral density
            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % max of periodogram power spectral density
            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER

            % 5 percentile of derivates
            F(1,78) = prctile(diff(J(:,2)),5); % dECG
            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER

            % 25 percentile of derivates
            F(1,84) = prctile(diff(J(:,2)),25); % dECG
            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER

            % 75 percentile of derivates
            F(1,90) = prctile(diff(J(:,2)),75); % dECG
            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
```

```
2173
2174            % 95 percentile of derivates
2175            F(1,96) = prctile(diff(J(:,2)),95); % dECG
2176            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
2177            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
2178            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
2179            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
2180            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
2181
2182
2183        % label
2184        F(1,102) = 0;
2185
2186        FeatureTable = vertcat(FeatureTable, F);
2187
2188
2189   % vp028_731
2190        file = 'F:\Processed\Splitted\vp028_splitted_731_beforeMS.csv';
2191
2192        % read .csv file
2193        fprintf('loading File ...\n');
2194        fprintf('Filename: %s', file(23:40));
2195        fprintf('\n');
2196        J = dlmread(file);
2197
2198        % calculate features
2199        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
2200
2201        % average
2202        F(1,1) = mean(J(:,2)); %ECG
2203        F(1,2) = mean(J(:,3)); %HR
2204        F(1,3) = mean(J(:,4)); %HrvHf
2205        F(1,4) = mean(J(:,5)); %HrvLf
2206        F(1,5) = mean(J(:,6)); %HrvLfHf
2207        F(1,6) = mean(J(:,7)); %HrvPnn50
2208        F(1,7) = mean(J(:,8)); %HrvRmssd
2209        F(1,8) = mean(J(:,9)); %HrvSd1
2210        F(1,9) = mean(J(:,10)); %HrvSd2
2211        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
2212        F(1,11) = mean(J(:,12)); %HrvSdnn
2213        F(1,12) = mean(J(:,13)); %HrvSdsd
2214        F(1,13) = mean(J(:,17)); %EYELIDOPENING
2215        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
2216
2217        % variance
2218        F(1,15) = var(J(:,2)); %ECG
2219        F(1,16) = var(J(:,17)); %EYELIDOPENING
2220        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
2221
2222        % brute force feature extraction
2223            % means of derivates
2224            F(1,18) = mean(diff(J(:,2))); % dECG
2225            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
2226            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
2227            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
2228            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2229            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
```

```
2230
2231            % skewness of derivates
2232            F(1,24) = skewness(diff(J(:,2))); % dECG
2233            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
2234            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
2235            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
2236            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2237            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2238
2239            % kurtosis of derivates
2240            F(1,30) = kurtosis(diff(J(:,2))); % dECG
2241            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
2242            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
2243            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
2244            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2245            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2246
2247            % min of derivates
2248            F(1,36) = min(diff(J(:,2))); % dECG
2249            F(1,37) = min(diff(J(:,2),2)); % d2ECG
2250            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
2251            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
2252            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2253            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2254
2255            % max of derivates
2256            F(1,42) = max(diff(J(:,2))); % dECG
2257            F(1,43) = max(diff(J(:,2),2)); % d2ECG
2258            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
2259            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
2260            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2261            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2262
2263            % means of periodogram power spectral density
2264            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
2265            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
2266            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2267            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2268            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2269            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2270
2271            % skewness of periodogram power spectral density
2272            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
2273            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
2274            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2275            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2276            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2277            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2278
2279            % kurtosis of periodogram power spectral density
2280            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
2281            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
2282            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2283            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2284            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2285            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
```

```
d2FILTEREDPUPILDIAMETER
2286
2287            % min of periodogram power spectral density
2288            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
2289            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
2290            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2291            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2292            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2293            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2294
2295            % max of periodogram power spectral density
2296            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
2297            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
2298            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2299            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2300            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2301            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2302
2303            % 5 percentile of derivates
2304            F(1,78) = prctile(diff(J(:,2)),5); % dECG
2305            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
2306            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
2307            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
2308            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
2309            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
2310
2311            % 25 percentile of derivates
2312            F(1,84) = prctile(diff(J(:,2)),25); % dECG
2313            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
2314            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
2315            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
2316            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
2317            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
2318
2319            % 75 percentile of derivates
2320            F(1,90) = prctile(diff(J(:,2)),75); % dECG
2321            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
2322            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
2323            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
2324            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
2325            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
2326
2327            % 95 percentile of derivates
2328            F(1,96) = prctile(diff(J(:,2)),95); % dECG
2329            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
2330            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
2331            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
2332            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
2333            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
2334
2335
2336        % label
2337        F(1,102) = 0;
2338
2339        FeatureTable = vertcat(FeatureTable, F);
2340
2341
2342  % vp029_18
```

```
2343        file = 'F:\Processed\Splitted\vp029_splitted_18_beforeMS.csv';
2344
2345        % read .csv file
2346        fprintf('loading File ...\n');
2347        fprintf('Filename: %s', file(23:40));
2348        fprintf('\n');
2349        J = dlmread(file);
2350
2351        % calculate features
2352        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
2353
2354        % average
2355        F(1,1) = mean(J(:,2)); %ECG
2356        F(1,2) = mean(J(:,3)); %HR
2357        F(1,3) = mean(J(:,4)); %HrvHf
2358        F(1,4) = mean(J(:,5)); %HrvLf
2359        F(1,5) = mean(J(:,6)); %HrvLfHf
2360        F(1,6) = mean(J(:,7)); %HrvPnn50
2361        F(1,7) = mean(J(:,8)); %HrvRmssd
2362        F(1,8) = mean(J(:,9)); %HrvSd1
2363        F(1,9) = mean(J(:,10)); %HrvSd2
2364        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
2365        F(1,11) = mean(J(:,12)); %HrvSdnn
2366        F(1,12) = mean(J(:,13)); %HrvSdsd
2367        F(1,13) = mean(J(:,17)); %EYELIDOPENING
2368        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
2369
2370        % variance
2371        F(1,15) = var(J(:,2)); %ECG
2372        F(1,16) = var(J(:,17)); %EYELIDOPENING
2373        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
2374
2375        % brute force feature extraction
2376            % means of derivates
2377            F(1,18) = mean(diff(J(:,2))); % dECG
2378            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
2379            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
2380            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
2381            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2382            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2383
2384            % skewness of derivates
2385            F(1,24) = skewness(diff(J(:,2))); % dECG
2386            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
2387            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
2388            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
2389            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2390            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2391
2392            % kurtosis of derivates
2393            F(1,30) = kurtosis(diff(J(:,2))); % dECG
2394            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
2395            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
2396            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
2397            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2398            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2399
```

```
2400            % min of derivates
2401            F(1,36) = min(diff(J(:,2))); % dECG
2402            F(1,37) = min(diff(J(:,2),2)); % d2ECG
2403            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
2404            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
2405            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2406            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2407
2408            % max of derivates
2409            F(1,42) = max(diff(J(:,2))); % dECG
2410            F(1,43) = max(diff(J(:,2),2)); % d2ECG
2411            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
2412            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
2413            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2414            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2415
2416            % means of periodogram power spectral density
2417            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
2418            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
2419            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2420            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2421            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2422            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2423
2424            % skewness of periodogram power spectral density
2425            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
2426            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
2427            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2428            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2429            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2430            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2431
2432            % kurtosis of periodogram power spectral density
2433            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
2434            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
2435            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2436            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2437            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2438            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2439
2440            % min of periodogram power spectral density
2441            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
2442            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
2443            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2444            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2445            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2446            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2447
2448            % max of periodogram power spectral density
2449            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
2450            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
2451            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2452            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2453            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
```

```
2454            F(1,77) = max(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
2455
2456            % 5 percentile of derivates
2457            F(1,78) = prctile(diff(J(:,2)),5);  % dECG
2458            F(1,79) = prctile(diff(J(:,2),2),5);  % d2ECG
2459            F(1,80) = prctile(diff(J(:,17)),5);  % dEYELIDOPENING
2460            F(1,81) = prctile(diff(J(:,17),2),5);  % d2EYELIDOPENING
2461            F(1,82) = prctile(diff(J(:,21)),5);  % dFILTEREDPUPILDIAMETER
2462            F(1,83) = prctile(diff(J(:,21),2),5);  % d2FILTEREDPUPILDIAMETER
2463
2464            % 25 percentile of derivates
2465            F(1,84) = prctile(diff(J(:,2)),25);  % dECG
2466            F(1,85) = prctile(diff(J(:,2),2),25);  % d2ECG
2467            F(1,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
2468            F(1,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
2469            F(1,88) = prctile(diff(J(:,21)),25);  % dFILTEREDPUPILDIAMETER
2470            F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
2471
2472            % 75 percentile of derivates
2473            F(1,90) = prctile(diff(J(:,2)),75);  % dECG
2474            F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
2475            F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
2476            F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
2477            F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
2478            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
2479
2480            % 95 percentile of derivates
2481            F(1,96) = prctile(diff(J(:,2)),95);  % dECG
2482            F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
2483            F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
2484            F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
2485            F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
2486            F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
2487
2488
2489        % label
2490        F(1,102) = 0;
2491
2492        FeatureTable = vertcat(FeatureTable, F);
2493
2494
2495   % vp029_17
2496        file = 'F:\Processed\Splitted\vp029_splitted_17_beforeMS.csv';
2497
2498        % read .csv file
2499        fprintf('loading File ...\n');
2500        fprintf('Filename: %s', file(23:40));
2501        fprintf('\n');
2502        J = dlmread(file);
2503
2504        % calculate features
2505        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
2506
2507        % average
2508        F(1,1) = mean(J(:,2));  %ECG
2509        F(1,2) = mean(J(:,3));  %HR
```

```
2510        F(1,3) = mean(J(:,4)); %HrvHf
2511        F(1,4) = mean(J(:,5)); %HrvLf
2512        F(1,5) = mean(J(:,6)); %HrvLfHf
2513        F(1,6) = mean(J(:,7)); %HrvPnn50
2514        F(1,7) = mean(J(:,8)); %HrvRmssd
2515        F(1,8) = mean(J(:,9)); %HrvSd1
2516        F(1,9) = mean(J(:,10)); %HrvSd2
2517        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
2518        F(1,11) = mean(J(:,12)); %HrvSdnn
2519        F(1,12) = mean(J(:,13)); %HrvSdsd
2520        F(1,13) = mean(J(:,17)); %EYELIDOPENING
2521        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
2522
2523        % variance
2524        F(1,15) = var(J(:,2)); %ECG
2525        F(1,16) = var(J(:,17)); %EYELIDOPENING
2526        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
2527
2528        % brute force feature extraction
2529            % means of derivates
2530            F(1,18) = mean(diff(J(:,2))); % dECG
2531            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
2532            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
2533            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
2534            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2535            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2536
2537            % skewness of derivates
2538            F(1,24) = skewness(diff(J(:,2))); % dECG
2539            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
2540            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
2541            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
2542            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2543            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2544
2545            % kurtosis of derivates
2546            F(1,30) = kurtosis(diff(J(:,2))); % dECG
2547            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
2548            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
2549            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
2550            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2551            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2552
2553            % min of derivates
2554            F(1,36) = min(diff(J(:,2))); % dECG
2555            F(1,37) = min(diff(J(:,2),2)); % d2ECG
2556            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
2557            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
2558            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2559            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2560
2561            % max of derivates
2562            F(1,42) = max(diff(J(:,2))); % dECG
2563            F(1,43) = max(diff(J(:,2),2)); % d2ECG
2564            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
2565            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
2566            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2567            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2568
2569            % means of periodogram power spectral density
```

```
2570            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
2571            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
2572            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2573            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2574            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2575            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2576
2577            % skewness of periodogram power spectral density
2578            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
2579            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
2580            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2581            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2582            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2583            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2584
2585            % kurtosis of periodogram power spectral density
2586            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
2587            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
2588            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2589            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2590            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2591            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2592
2593            % min of periodogram power spectral density
2594            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
2595            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
2596            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2597            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2598            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2599            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2600
2601            % max of periodogram power spectral density
2602            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
2603            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
2604            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2605            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2606            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2607            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2608
2609            % 5 percentile of derivates
2610            F(1,78) = prctile(diff(J(:,2)),5); % dECG
2611            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
2612            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
2613            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
2614            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
2615            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
2616
2617            % 25 percentile of derivates
2618            F(1,84) = prctile(diff(J(:,2)),25); % dECG
2619            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
2620            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
2621            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
2622            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
```

```
2623            F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
2624
2625            % 75 percentile of derivates
2626            F(1,90) = prctile(diff(J(:,2)),75);  % dECG
2627            F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
2628            F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
2629            F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
2630            F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
2631            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
2632
2633            % 95 percentile of derivates
2634            F(1,96) = prctile(diff(J(:,2)),95);  % dECG
2635            F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
2636            F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
2637            F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
2638            F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
2639            F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
2640
2641
2642        % label
2643        F(1,102) = 0;
2644
2645        FeatureTable = vertcat(FeatureTable, F);
2646
2647
2648   % vp030_286
2649        file = 'F:\Processed\Splitted\vp030_splitted_286_beforeMS.csv';
2650
2651        % read .csv file
2652        fprintf('loading File ...\n');
2653        fprintf('Filename: %s', file(23:40));
2654        fprintf('\n');
2655        J = dlmread(file);
2656
2657        % calculate features
2658        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
2659
2660        % average
2661        F(1,1) = mean(J(:,2));  %ECG
2662        F(1,2) = mean(J(:,3));  %HR
2663        F(1,3) = mean(J(:,4));  %HrvHf
2664        F(1,4) = mean(J(:,5));  %HrvLf
2665        F(1,5) = mean(J(:,6));  %HrvLfHf
2666        F(1,6) = mean(J(:,7));  %HrvPnn50
2667        F(1,7) = mean(J(:,8));  %HrvRmssd
2668        F(1,8) = mean(J(:,9));  %HrvSd1
2669        F(1,9) = mean(J(:,10));  %HrvSd2
2670        F(1,10) = mean(J(:,11));  %HrvSd2Sd1
2671        F(1,11) = mean(J(:,12));  %HrvSdnn
2672        F(1,12) = mean(J(:,13));  %HrvSdsd
2673        F(1,13) = mean(J(:,17));  %EYELIDOPENING
2674        F(1,14) = mean(J(:,21));  %FILTEREDPUPILDIAMETER
2675
2676        % variance
2677        F(1,15) = var(J(:,2));  %ECG
2678        F(1,16) = var(J(:,17));  %EYELIDOPENING
2679        F(1,17) = var(J(:,21));  %FILTEREDPUPILDIAMETER
```

```
2680
2681        % brute force feature extraction
2682            % means of derivates
2683            F(1,18) = mean(diff(J(:,2))); % dECG
2684            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
2685            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
2686            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
2687            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2688            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2689
2690            % skewness of derivates
2691            F(1,24) = skewness(diff(J(:,2))); % dECG
2692            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
2693            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
2694            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
2695            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2696            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2697
2698            % kurtosis of derivates
2699            F(1,30) = kurtosis(diff(J(:,2))); % dECG
2700            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
2701            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
2702            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
2703            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2704            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2705
2706            % min of derivates
2707            F(1,36) = min(diff(J(:,2))); % dECG
2708            F(1,37) = min(diff(J(:,2),2)); % d2ECG
2709            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
2710            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
2711            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2712            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2713
2714            % max of derivates
2715            F(1,42) = max(diff(J(:,2))); % dECG
2716            F(1,43) = max(diff(J(:,2),2)); % d2ECG
2717            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
2718            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
2719            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2720            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2721
2722            % means of periodogram power spectral density
2723            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
2724            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
2725            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2726            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2727            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2728            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2729
2730            % skewness of periodogram power spectral density
2731            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
2732            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
2733            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2734            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2735            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2736            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
```

```
2737
2738            % kurtosis of periodogram power spectral density
2739            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
2740            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
2741            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2742            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2743            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2744            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2745
2746            % min of periodogram power spectral density
2747            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
2748            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
2749            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2750            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2751            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2752            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2753
2754            % max of periodogram power spectral density
2755            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
2756            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
2757            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2758            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2759            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2760            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2761
2762            % 5 percentile of derivates
2763            F(1,78) = prctile(diff(J(:,2)),5); % dECG
2764            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
2765            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
2766            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
2767            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
2768            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
2769
2770            % 25 percentile of derivates
2771            F(1,84) = prctile(diff(J(:,2)),25); % dECG
2772            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
2773            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
2774            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
2775            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
2776            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
2777
2778            % 75 percentile of derivates
2779            F(1,90) = prctile(diff(J(:,2)),75); % dECG
2780            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
2781            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
2782            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
2783            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
2784            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
2785
2786            % 95 percentile of derivates
2787            F(1,96) = prctile(diff(J(:,2)),95); % dECG
2788            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
2789            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
2790            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
2791            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
2792            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
```

```
2793
2794
2795        % label
2796        F(1,102) = 0;
2797
2798        FeatureTable = vertcat(FeatureTable, F);
2799
2800
2801   % vp030_285
2802        file = 'F:\Processed\Splitted\vp030_splitted_285_beforeMS.csv';
2803
2804        % read .csv file
2805        fprintf('loading File ...\n');
2806        fprintf('Filename: %s', file(23:40));
2807        fprintf('\n');
2808        J = dlmread(file);
2809
2810        % calculate features
2811        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
2812
2813        % average
2814        F(1,1) = mean(J(:,2)); %ECG
2815        F(1,2) = mean(J(:,3)); %HR
2816        F(1,3) = mean(J(:,4)); %HrvHf
2817        F(1,4) = mean(J(:,5)); %HrvLf
2818        F(1,5) = mean(J(:,6)); %HrvLfHf
2819        F(1,6) = mean(J(:,7)); %HrvPnn50
2820        F(1,7) = mean(J(:,8)); %HrvRmssd
2821        F(1,8) = mean(J(:,9)); %HrvSd1
2822        F(1,9) = mean(J(:,10)); %HrvSd2
2823        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
2824        F(1,11) = mean(J(:,12)); %HrvSdnn
2825        F(1,12) = mean(J(:,13)); %HrvSdsd
2826        F(1,13) = mean(J(:,17)); %EYELIDOPENING
2827        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
2828
2829        % variance
2830        F(1,15) = var(J(:,2)); %ECG
2831        F(1,16) = var(J(:,17)); %EYELIDOPENING
2832        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
2833
2834        % brute force feature extraction
2835            % means of derivates
2836            F(1,18) = mean(diff(J(:,2))); % dECG
2837            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
2838            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
2839            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
2840            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2841            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2842
2843            % skewness of derivates
2844            F(1,24) = skewness(diff(J(:,2))); % dECG
2845            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
2846            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
2847            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
2848            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2849            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
```

```
2850
2851            % kurtosis of derivates
2852            F(1,30) = kurtosis(diff(J(:,2))); % dECG
2853            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
2854            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
2855            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
2856            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2857            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2858
2859            % min of derivates
2860            F(1,36) = min(diff(J(:,2))); % dECG
2861            F(1,37) = min(diff(J(:,2),2)); % d2ECG
2862            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
2863            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
2864            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2865            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2866
2867            % max of derivates
2868            F(1,42) = max(diff(J(:,2))); % dECG
2869            F(1,43) = max(diff(J(:,2),2)); % d2ECG
2870            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
2871            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
2872            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2873            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2874
2875            % means of periodogram power spectral density
2876            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
2877            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
2878            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2879            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2880            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
2881            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2882
2883            % skewness of periodogram power spectral density
2884            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
2885            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
2886            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2887            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2888            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2889            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2890
2891            % kurtosis of periodogram power spectral density
2892            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
2893            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
2894            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2895            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2896            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
2897            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
2898
2899            % min of periodogram power spectral density
2900            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
2901            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
2902            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
2903            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
2904            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
```

```
2905            F(1,71) = min(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
2906
2907            % max of periodogram power spectral density
2908            F(1,72) = max(periodogram(diff(J(:,2))));  % dECG
2909            F(1,73) = max(periodogram(diff(J(:,2),2)));  % d2ECG
2910            F(1,74) = max(periodogram(diff(J(:,17))));  % dEYELIDOPENING
2911            F(1,75) = max(periodogram(diff(J(:,17),2)));  % d2EYELIDOPENING
2912            F(1,76) = max(periodogram(diff(J(:,21))));  % dFILTEREDPUPILDIAMETER
2913            F(1,77) = max(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
2914
2915            % 5 percentile of derivates
2916            F(1,78) = prctile(diff(J(:,2)),5);  % dECG
2917            F(1,79) = prctile(diff(J(:,2),2),5);  % d2ECG
2918            F(1,80) = prctile(diff(J(:,17)),5);  % dEYELIDOPENING
2919            F(1,81) = prctile(diff(J(:,17),2),5);  % d2EYELIDOPENING
2920            F(1,82) = prctile(diff(J(:,21)),5);  % dFILTEREDPUPILDIAMETER
2921            F(1,83) = prctile(diff(J(:,21),2),5);  % d2FILTEREDPUPILDIAMETER
2922
2923            % 25 percentile of derivates
2924            F(1,84) = prctile(diff(J(:,2)),25);  % dECG
2925            F(1,85) = prctile(diff(J(:,2),2),25);  % d2ECG
2926            F(1,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
2927            F(1,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
2928            F(1,88) = prctile(diff(J(:,21)),25);  % dFILTEREDPUPILDIAMETER
2929            F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
2930
2931            % 75 percentile of derivates
2932            F(1,90) = prctile(diff(J(:,2)),75);  % dECG
2933            F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
2934            F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
2935            F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
2936            F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
2937            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
2938
2939            % 95 percentile of derivates
2940            F(1,96) = prctile(diff(J(:,2)),95);  % dECG
2941            F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
2942            F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
2943            F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
2944            F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
2945            F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
2946
2947
2948        % label
2949        F(1,102) = 0;
2950
2951        FeatureTable = vertcat(FeatureTable, F);
2952
2953
2954   % vp031_93
2955        file = 'F:\Processed\Splitted\vp031_splitted_93_beforeMS.csv';
2956
2957        % read .csv file
2958        fprintf('loading File ...\n');
2959        fprintf('Filename: %s', file(23:40));
2960        fprintf('\n');
2961        J = dlmread(file);
2962
```

```
2963        % calculate features
2964        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
2965
2966        % average
2967        F(1,1) = mean(J(:,2)); %ECG
2968        F(1,2) = mean(J(:,3)); %HR
2969        F(1,3) = mean(J(:,4)); %HrvHf
2970        F(1,4) = mean(J(:,5)); %HrvLf
2971        F(1,5) = mean(J(:,6)); %HrvLfHf
2972        F(1,6) = mean(J(:,7)); %HrvPnn50
2973        F(1,7) = mean(J(:,8)); %HrvRmssd
2974        F(1,8) = mean(J(:,9)); %HrvSd1
2975        F(1,9) = mean(J(:,10)); %HrvSd2
2976        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
2977        F(1,11) = mean(J(:,12)); %HrvSdnn
2978        F(1,12) = mean(J(:,13)); %HrvSdsd
2979        F(1,13) = mean(J(:,17)); %EYELIDOPENING
2980        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
2981
2982        % variance
2983        F(1,15) = var(J(:,2)); %ECG
2984        F(1,16) = var(J(:,17)); %EYELIDOPENING
2985        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
2986
2987        % brute force feature extraction
2988            % means of derivates
2989            F(1,18) = mean(diff(J(:,2))); % dECG
2990            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
2991            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
2992            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
2993            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
2994            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
2995
2996            % skewness of derivates
2997            F(1,24) = skewness(diff(J(:,2))); % dECG
2998            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
2999            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
3000            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
3001            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3002            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3003
3004            % kurtosis of derivates
3005            F(1,30) = kurtosis(diff(J(:,2))); % dECG
3006            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
3007            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
3008            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
3009            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3010            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3011
3012            % min of derivates
3013            F(1,36) = min(diff(J(:,2))); % dECG
3014            F(1,37) = min(diff(J(:,2),2)); % d2ECG
3015            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
3016            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
3017            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3018            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3019
```

```
3020            % max of derivates
3021            F(1,42) = max(diff(J(:,2))); % dECG
3022            F(1,43) = max(diff(J(:,2),2)); % d2ECG
3023            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
3024            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
3025            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3026            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3027
3028            % means of periodogram power spectral density
3029            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
3030            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
3031            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3032            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3033            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3034            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3035
3036            % skewness of periodogram power spectral density
3037            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
3038            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
3039            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3040            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3041            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
3042            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3043
3044            % kurtosis of periodogram power spectral density
3045            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
3046            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
3047            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3048            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3049            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
3050            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3051
3052            % min of periodogram power spectral density
3053            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
3054            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
3055            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3056            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3057            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3058            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3059
3060            % max of periodogram power spectral density
3061            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
3062            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
3063            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3064            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3065            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3066            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3067
3068            % 5 percentile of derivates
3069            F(1,78) = prctile(diff(J(:,2)),5); % dECG
3070            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
3071            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
3072            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
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3073            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
3074            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
3075
3076            % 25 percentile of derivates
3077            F(1,84) = prctile(diff(J(:,2)),25); % dECG
3078            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
3079            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
3080            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
3081            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
3082            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
3083
3084            % 75 percentile of derivates
3085            F(1,90) = prctile(diff(J(:,2)),75); % dECG
3086            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
3087            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
3088            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
3089            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
3090            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
3091
3092            % 95 percentile of derivates
3093            F(1,96) = prctile(diff(J(:,2)),95); % dECG
3094            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
3095            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
3096            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
3097            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
3098            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
3099
3100
3101        % label
3102        F(1,102) = 0;
3103
3104        FeatureTable = vertcat(FeatureTable, F);
3105
3106
3107   % vp031_92
3108        file = 'F:\Processed\Splitted\vp031_splitted_92_beforeMS.csv';
3109
3110        % read .csv file
3111        fprintf('loading File ...\n');
3112        fprintf('Filename: %s', file(23:40));
3113        fprintf('\n');
3114        J = dlmread(file);
3115
3116        % calculate features
3117        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
3118
3119        % average
3120        F(1,1) = mean(J(:,2)); %ECG
3121        F(1,2) = mean(J(:,3)); %HR
3122        F(1,3) = mean(J(:,4)); %HrvHf
3123        F(1,4) = mean(J(:,5)); %HrvLf
3124        F(1,5) = mean(J(:,6)); %HrvLfHf
3125        F(1,6) = mean(J(:,7)); %HrvPnn50
3126        F(1,7) = mean(J(:,8)); %HrvRmssd
3127        F(1,8) = mean(J(:,9)); %HrvSd1
3128        F(1,9) = mean(J(:,10)); %HrvSd2
3129        F(1,10) = mean(J(:,11)); %HrvSd2Sd1
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3130        F(1,11) = mean(J(:,12)); %HrvSdnn
3131        F(1,12) = mean(J(:,13)); %HrvSdsd
3132        F(1,13) = mean(J(:,17)); %EYELIDOPENING
3133        F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
3134
3135        % variance
3136        F(1,15) = var(J(:,2)); %ECG
3137        F(1,16) = var(J(:,17)); %EYELIDOPENING
3138        F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
3139
3140        % brute force feature extraction
3141            % means of derivates
3142            F(1,18) = mean(diff(J(:,2))); % dECG
3143            F(1,19) = mean(diff(J(:,2),2)); % d2ECG
3144            F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
3145            F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
3146            F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3147            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3148
3149            % skewness of derivates
3150            F(1,24) = skewness(diff(J(:,2))); % dECG
3151            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
3152            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
3153            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
3154            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3155            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3156
3157            % kurtosis of derivates
3158            F(1,30) = kurtosis(diff(J(:,2))); % dECG
3159            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
3160            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
3161            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
3162            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3163            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3164
3165            % min of derivates
3166            F(1,36) = min(diff(J(:,2))); % dECG
3167            F(1,37) = min(diff(J(:,2),2)); % d2ECG
3168            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
3169            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
3170            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3171            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3172
3173            % max of derivates
3174            F(1,42) = max(diff(J(:,2))); % dECG
3175            F(1,43) = max(diff(J(:,2),2)); % d2ECG
3176            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
3177            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
3178            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3179            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3180
3181            % means of periodogram power spectral density
3182            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
3183            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
3184            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3185            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3186            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3187            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3188
```

```
3189            % skewness of periodogram power spectral density
3190            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
3191            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
3192            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3193            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3194            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
3195            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3196
3197            % kurtosis of periodogram power spectral density
3198            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
3199            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
3200            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3201            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3202            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
3203            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3204
3205            % min of periodogram power spectral density
3206            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
3207            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
3208            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3209            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3210            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3211            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3212
3213            % max of periodogram power spectral density
3214            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
3215            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
3216            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3217            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3218            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3219            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3220
3221            % 5 percentile of derivates
3222            F(1,78) = prctile(diff(J(:,2)),5); % dECG
3223            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
3224            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
3225            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
3226            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
3227            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
3228
3229            % 25 percentile of derivates
3230            F(1,84) = prctile(diff(J(:,2)),25); % dECG
3231            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
3232            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
3233            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
3234            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
3235            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
3236
3237            % 75 percentile of derivates
3238            F(1,90) = prctile(diff(J(:,2)),75); % dECG
3239            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
3240            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
3241            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
3242            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
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3243            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
3244
3245            % 95 percentile of derivates
3246            F(1,96) = prctile(diff(J(:,2)),95);  % dECG
3247            F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
3248            F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
3249            F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
3250            F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
3251            F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
3252
3253
3254        % label
3255        F(1,102) = 0;
3256
3257        FeatureTable = vertcat(FeatureTable, F);
3258
3259
3260   % vp032_207
3261        file = 'F:\Processed\Splitted\vp032_splitted_207_beforeMS.csv';
3262
3263        % read .csv file
3264        fprintf('loading File ...\n');
3265        fprintf('Filename: %s', file(23:40));
3266        fprintf('\n');
3267        J = dlmread(file);
3268
3269        % calculate features
3270        % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
3271
3272        % average
3273        F(1,1) = mean(J(:,2));  %ECG
3274        F(1,2) = mean(J(:,3));  %HR
3275        F(1,3) = mean(J(:,4));  %HrvHf
3276        F(1,4) = mean(J(:,5));  %HrvLf
3277        F(1,5) = mean(J(:,6));  %HrvLfHf
3278        F(1,6) = mean(J(:,7));  %HrvPnn50
3279        F(1,7) = mean(J(:,8));  %HrvRmssd
3280        F(1,8) = mean(J(:,9));  %HrvSd1
3281        F(1,9) = mean(J(:,10));  %HrvSd2
3282        F(1,10) = mean(J(:,11));  %HrvSd2Sd1
3283        F(1,11) = mean(J(:,12));  %HrvSdnn
3284        F(1,12) = mean(J(:,13));  %HrvSdsd
3285        F(1,13) = mean(J(:,17));  %EYELIDOPENING
3286        F(1,14) = mean(J(:,21));  %FILTEREDPUPILDIAMETER
3287
3288        % variance
3289        F(1,15) = var(J(:,2));  %ECG
3290        F(1,16) = var(J(:,17));  %EYELIDOPENING
3291        F(1,17) = var(J(:,21));  %FILTEREDPUPILDIAMETER
3292
3293        % brute force feature extraction
3294            % means of derivates
3295            F(1,18) = mean(diff(J(:,2)));  % dECG
3296            F(1,19) = mean(diff(J(:,2),2));  % d2ECG
3297            F(1,20) = mean(diff(J(:,17)));  % dEYELIDOPENING
3298            F(1,21) = mean(diff(J(:,17),2));  % d2EYELIDOPENING
3299            F(1,22) = mean(diff(J(:,21)));  % dFILTEREDPUPILDIAMETER
```

```
3300            F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3301
3302            % skewness of derivates
3303            F(1,24) = skewness(diff(J(:,2))); % dECG
3304            F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
3305            F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
3306            F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
3307            F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3308            F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3309
3310            % kurtosis of derivates
3311            F(1,30) = kurtosis(diff(J(:,2))); % dECG
3312            F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
3313            F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
3314            F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
3315            F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3316            F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3317
3318            % min of derivates
3319            F(1,36) = min(diff(J(:,2))); % dECG
3320            F(1,37) = min(diff(J(:,2),2)); % d2ECG
3321            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
3322            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
3323            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3324            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3325
3326            % max of derivates
3327            F(1,42) = max(diff(J(:,2))); % dECG
3328            F(1,43) = max(diff(J(:,2),2)); % d2ECG
3329            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
3330            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
3331            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3332            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3333
3334            % means of periodogram power spectral density
3335            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
3336            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
3337            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3338            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3339            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3340            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3341
3342            % skewness of periodogram power spectral density
3343            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
3344            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
3345            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3346            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3347            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
3348            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3349
3350            % kurtosis of periodogram power spectral density
3351            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
3352            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
3353            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3354            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3355            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
```

```
3356            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3357
3358            % min of periodogram power spectral density
3359            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
3360            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
3361            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3362            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3363            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3364            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3365
3366            % max of periodogram power spectral density
3367            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
3368            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
3369            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3370            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3371            F(1,76) = max(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3372            F(1,77) = max(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3373
3374            % 5 percentile of derivates
3375            F(1,78) = prctile(diff(J(:,2)),5); % dECG
3376            F(1,79) = prctile(diff(J(:,2),2),5); % d2ECG
3377            F(1,80) = prctile(diff(J(:,17)),5); % dEYELIDOPENING
3378            F(1,81) = prctile(diff(J(:,17),2),5); % d2EYELIDOPENING
3379            F(1,82) = prctile(diff(J(:,21)),5); % dFILTEREDPUPILDIAMETER
3380            F(1,83) = prctile(diff(J(:,21),2),5); % d2FILTEREDPUPILDIAMETER
3381
3382            % 25 percentile of derivates
3383            F(1,84) = prctile(diff(J(:,2)),25); % dECG
3384            F(1,85) = prctile(diff(J(:,2),2),25); % d2ECG
3385            F(1,86) = prctile(diff(J(:,17)),25); % dEYELIDOPENING
3386            F(1,87) = prctile(diff(J(:,17),2),25); % d2EYELIDOPENING
3387            F(1,88) = prctile(diff(J(:,21)),25); % dFILTEREDPUPILDIAMETER
3388            F(1,89) = prctile(diff(J(:,21),2),25); % d2FILTEREDPUPILDIAMETER
3389
3390            % 75 percentile of derivates
3391            F(1,90) = prctile(diff(J(:,2)),75); % dECG
3392            F(1,91) = prctile(diff(J(:,2),2),75); % d2ECG
3393            F(1,92) = prctile(diff(J(:,17)),75); % dEYELIDOPENING
3394            F(1,93) = prctile(diff(J(:,17),2),75); % d2EYELIDOPENING
3395            F(1,94) = prctile(diff(J(:,21)),75); % dFILTEREDPUPILDIAMETER
3396            F(1,95) = prctile(diff(J(:,21),2),75); % d2FILTEREDPUPILDIAMETER
3397
3398            % 95 percentile of derivates
3399            F(1,96) = prctile(diff(J(:,2)),95); % dECG
3400            F(1,97) = prctile(diff(J(:,2),2),95); % d2ECG
3401            F(1,98) = prctile(diff(J(:,17)),95); % dEYELIDOPENING
3402            F(1,99) = prctile(diff(J(:,17),2),95); % d2EYELIDOPENING
3403            F(1,100) = prctile(diff(J(:,21)),95); % dFILTEREDPUPILDIAMETER
3404            F(1,101) = prctile(diff(J(:,21),2),95); % d2FILTEREDPUPILDIAMETER
3405
3406
3407        % label
3408        F(1,102) = 0;
3409
3410        FeatureTable = vertcat(FeatureTable, F);
3411
3412
```

```
3413   % vp032_206
3414         file = 'F:\Processed\Splitted\vp032_splitted_206_beforeMS.csv';
3415
3416         % read .csv file
3417         fprintf('loading File ...\n');
3418         fprintf('Filename: %s', file(23:40));
3419         fprintf('\n');
3420         J = dlmread(file);
3421
3422         % calculate features
3423         % HEADER(TIMELINE, ECG, HR, HrvHf, HrvLf, HrvLfHf, HrvPnn50, HrvRmssd, ↙
HrvSd1, HrvSd2, HrvSd2Sd1, HrvSdnn, HrvSdsd, TIMESTAMP, FRAMENUMBER, FRAMERATE, ↙
EYELIDOPENING, EYELIDOPENINGQ, PUPILDIAMETER, PUPILDIAMETERQ, FILTEREDPUPILDIAMETER, ↙
FILTEREDPUPILDIAMETERQ);
3424
3425         % average
3426         F(1,1) = mean(J(:,2)); %ECG
3427         F(1,2) = mean(J(:,3)); %HR
3428         F(1,3) = mean(J(:,4)); %HrvHf
3429         F(1,4) = mean(J(:,5)); %HrvLf
3430         F(1,5) = mean(J(:,6)); %HrvLfHf
3431         F(1,6) = mean(J(:,7)); %HrvPnn50
3432         F(1,7) = mean(J(:,8)); %HrvRmssd
3433         F(1,8) = mean(J(:,9)); %HrvSd1
3434         F(1,9) = mean(J(:,10)); %HrvSd2
3435         F(1,10) = mean(J(:,11)); %HrvSd2Sd1
3436         F(1,11) = mean(J(:,12)); %HrvSdnn
3437         F(1,12) = mean(J(:,13)); %HrvSdsd
3438         F(1,13) = mean(J(:,17)); %EYELIDOPENING
3439         F(1,14) = mean(J(:,21)); %FILTEREDPUPILDIAMETER
3440
3441         % variance
3442         F(1,15) = var(J(:,2)); %ECG
3443         F(1,16) = var(J(:,17)); %EYELIDOPENING
3444         F(1,17) = var(J(:,21)); %FILTEREDPUPILDIAMETER
3445
3446         % brute force feature extraction
3447             % means of derivates
3448             F(1,18) = mean(diff(J(:,2))); % dECG
3449             F(1,19) = mean(diff(J(:,2),2)); % d2ECG
3450             F(1,20) = mean(diff(J(:,17))); % dEYELIDOPENING
3451             F(1,21) = mean(diff(J(:,17),2)); % d2EYELIDOPENING
3452             F(1,22) = mean(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3453             F(1,23) = mean(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3454
3455             % skewness of derivates
3456             F(1,24) = skewness(diff(J(:,2))); % dECG
3457             F(1,25) = skewness(diff(J(:,2),2)); % d2ECG
3458             F(1,26) = skewness(diff(J(:,17))); % dEYELIDOPENING
3459             F(1,27) = skewness(diff(J(:,17),2)); % d2EYELIDOPENING
3460             F(1,28) = skewness(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3461             F(1,29) = skewness(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3462
3463             % kurtosis of derivates
3464             F(1,30) = kurtosis(diff(J(:,2))); % dECG
3465             F(1,31) = kurtosis(diff(J(:,2),2)); % d2ECG
3466             F(1,32) = kurtosis(diff(J(:,17))); % dEYELIDOPENING
3467             F(1,33) = kurtosis(diff(J(:,17),2)); % d2EYELIDOPENING
3468             F(1,34) = kurtosis(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3469             F(1,35) = kurtosis(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
```

```
3470
3471            % min of derivates
3472            F(1,36) = min(diff(J(:,2))); % dECG
3473            F(1,37) = min(diff(J(:,2),2)); % d2ECG
3474            F(1,38) = min(diff(J(:,17))); % dEYELIDOPENING
3475            F(1,39) = min(diff(J(:,17),2)); % d2EYELIDOPENING
3476            F(1,40) = min(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3477            F(1,41) = min(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3478
3479            % max of derivates
3480            F(1,42) = max(diff(J(:,2))); % dECG
3481            F(1,43) = max(diff(J(:,2),2)); % d2ECG
3482            F(1,44) = max(diff(J(:,17))); % dEYELIDOPENING
3483            F(1,45) = max(diff(J(:,17),2)); % d2EYELIDOPENING
3484            F(1,46) = max(diff(J(:,21))); % dFILTEREDPUPILDIAMETER
3485            F(1,47) = max(diff(J(:,21),2)); % d2FILTEREDPUPILDIAMETER
3486
3487            % means of periodogram power spectral density
3488            F(1,48) = mean(periodogram(diff(J(:,2)))); % dECG
3489            F(1,49) = mean(periodogram(diff(J(:,2),2))); % d2ECG
3490            F(1,50) = mean(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3491            F(1,51) = mean(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3492            F(1,52) = mean(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3493            F(1,53) = mean(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3494
3495            % skewness of periodogram power spectral density
3496            F(1,54) = skewness(periodogram(diff(J(:,2)))); % dECG
3497            F(1,55) = skewness(periodogram(diff(J(:,2),2))); % d2ECG
3498            F(1,56) = skewness(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3499            F(1,57) = skewness(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3500            F(1,58) = skewness(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
3501            F(1,59) = skewness(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3502
3503            % kurtosis of periodogram power spectral density
3504            F(1,60) = kurtosis(periodogram(diff(J(:,2)))); % dECG
3505            F(1,61) = kurtosis(periodogram(diff(J(:,2),2))); % d2ECG
3506            F(1,62) = kurtosis(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3507            F(1,63) = kurtosis(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3508            F(1,64) = kurtosis(periodogram(diff(J(:,21)))); %↙
dFILTEREDPUPILDIAMETER
3509            F(1,65) = kurtosis(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3510
3511            % min of periodogram power spectral density
3512            F(1,66) = min(periodogram(diff(J(:,2)))); % dECG
3513            F(1,67) = min(periodogram(diff(J(:,2),2))); % d2ECG
3514            F(1,68) = min(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3515            F(1,69) = min(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
3516            F(1,70) = min(periodogram(diff(J(:,21)))); % dFILTEREDPUPILDIAMETER
3517            F(1,71) = min(periodogram(diff(J(:,21),2))); %↙
d2FILTEREDPUPILDIAMETER
3518
3519            % max of periodogram power spectral density
3520            F(1,72) = max(periodogram(diff(J(:,2)))); % dECG
3521            F(1,73) = max(periodogram(diff(J(:,2),2))); % d2ECG
3522            F(1,74) = max(periodogram(diff(J(:,17)))); % dEYELIDOPENING
3523            F(1,75) = max(periodogram(diff(J(:,17),2))); % d2EYELIDOPENING
```

```
3524            F(1,76) = max(periodogram(diff(J(:,21))));  % dFILTEREDPUPILDIAMETER
3525            F(1,77) = max(periodogram(diff(J(:,21),2)));  %↙
d2FILTEREDPUPILDIAMETER
3526
3527            % 5 percentile of derivates
3528            F(1,78) = prctile(diff(J(:,2)),5);  % dECG
3529            F(1,79) = prctile(diff(J(:,2),2),5);  % d2ECG
3530            F(1,80) = prctile(diff(J(:,17)),5);  % dEYELIDOPENING
3531            F(1,81) = prctile(diff(J(:,17),2),5);  % d2EYELIDOPENING
3532            F(1,82) = prctile(diff(J(:,21)),5);  % dFILTEREDPUPILDIAMETER
3533            F(1,83) = prctile(diff(J(:,21),2),5);  % d2FILTEREDPUPILDIAMETER
3534
3535            % 25 percentile of derivates
3536            F(1,84) = prctile(diff(J(:,2)),25);  % dECG
3537            F(1,85) = prctile(diff(J(:,2),2),25);  % d2ECG
3538            F(1,86) = prctile(diff(J(:,17)),25);  % dEYELIDOPENING
3539            F(1,87) = prctile(diff(J(:,17),2),25);  % d2EYELIDOPENING
3540            F(1,88) = prctile(diff(J(:,21)),25);  % dFILTEREDPUPILDIAMETER
3541            F(1,89) = prctile(diff(J(:,21),2),25);  % d2FILTEREDPUPILDIAMETER
3542
3543            % 75 percentile of derivates
3544            F(1,90) = prctile(diff(J(:,2)),75);  % dECG
3545            F(1,91) = prctile(diff(J(:,2),2),75);  % d2ECG
3546            F(1,92) = prctile(diff(J(:,17)),75);  % dEYELIDOPENING
3547            F(1,93) = prctile(diff(J(:,17),2),75);  % d2EYELIDOPENING
3548            F(1,94) = prctile(diff(J(:,21)),75);  % dFILTEREDPUPILDIAMETER
3549            F(1,95) = prctile(diff(J(:,21),2),75);  % d2FILTEREDPUPILDIAMETER
3550
3551            % 95 percentile of derivates
3552            F(1,96) = prctile(diff(J(:,2)),95);  % dECG
3553            F(1,97) = prctile(diff(J(:,2),2),95);  % d2ECG
3554            F(1,98) = prctile(diff(J(:,17)),95);  % dEYELIDOPENING
3555            F(1,99) = prctile(diff(J(:,17),2),95);  % d2EYELIDOPENING
3556            F(1,100) = prctile(diff(J(:,21)),95);  % dFILTEREDPUPILDIAMETER
3557            F(1,101) = prctile(diff(J(:,21),2),95);  % d2FILTEREDPUPILDIAMETER
3558
3559
3560        % label
3561        F(1,102) = 0;
3562
3563        FeatureTable = vertcat(FeatureTable, F);
3564
3565        % write to csv
3566        fprintf('Writing file...\n');
3567        CSVfile = strcat('F:\Processed\','feature array','.csv'); %where to store↙
the outputs...
3568        dlmwrite(CSVfile, FeatureTable,'precision','%10.5f'); %missing header
3569        fprintf('Done! ');
3570
3571 %% generate feature Table
3572
3573 FeatureTable  = array2table(FeatureTable);
3574 FeatureTable.Properties.VariableNames = {'meanECG' 'HR' 'HrvHf' 'HrvLf' 'HrvLfHf' ↙
'HrvPnn50' 'HrvRmssd' 'HrvSd1' 'HrvSd2' 'HrvSd2Sd1' 'HrvSdnn' 'HrvSdsd' ↙
'meanEYELIDOPENING' 'meanFILTEREDPUPILDIAMETER' 'varECG' 'varEYELIDOPENING' ↙
'varFILTEREDPUPILDIAMETER' 'meandECG' 'meand2ECG' 'meandEYELIDOPENING' ↙
'meand2EYELIDOPENING' 'meandFILTEREDPUPILDIAMETER' 'meand2FILTEREDPUPILDIAMETER' ↙
'skwdECG' 'skwd2ECG' 'skwdEYELIDOPENING' 'skwd2EYELIDOPENING' ↙
'skwdFILTEREDPUPILDIAMETER' 'skwd2FILTEREDPUPILDIAMETER' 'kurtdECG' 'kurtd2ECG' ↙
'kurtdEYELIDOPENING' 'kurtd2EYELIDOPENING' 'kurtdFILTEREDPUPILDIAMETER' ↙
```

```
'kurtd2FILTEREDPUPILDIAMETER' 'mindECG' 'mind2ECG' 'mindEYELIDOPENING' ↙
'mind2EYELIDOPENING' 'mindFILTEREDPUPILDIAMETER' 'mind2FILTEREDPUPILDIAMETER' ↙
'maxdECG' 'maxd2ECG' 'maxdEYELIDOPENING' 'maxd2EYELIDOPENING' ↙
'maxdFILTEREDPUPILDIAMETER' 'maxd2FILTEREDPUPILDIAMETER'  'meanPSDdECG' 'meanPSDd2ECG' ↙
'meanPSDdEYELIDOPENING' 'meanPSDd2EYELIDOPENING' 'meanPSDdFILTEREDPUPILDIAMETER' ↙
'meanPSDd2FILTEREDPUPILDIAMETER' 'skwPSDdECG' 'skwPSDd2ECG' 'skwPSDdEYELIDOPENING' ↙
'skwPSDd2EYELIDOPENING' 'skwPSDdFILTEREDPUPILDIAMETER' 'skwPSDd2FILTEREDPUPILDIAMETER' ↙
'kurtPSDdECG' 'kurtPSDd2ECG' 'kurtPSDdEYELIDOPENING' 'kurtPSDd2EYELIDOPENING' ↙
'kurtPSDdFILTEREDPUPILDIAMETER' 'kurtPSDd2FILTEREDPUPILDIAMETER' 'minPSDdECG' ↙
'minPSDd2ECG' 'minPSDdEYELIDOPENING' 'minPSDd2EYELIDOPENING' ↙
'minPSDdFILTEREDPUPILDIAMETER' 'minPSDd2FILTEREDPUPILDIAMETER' 'maxPSDdECG' ↙
'maxPSDd2ECG' 'maxPSDdEYELIDOPENING' 'maxPSDd2EYELIDOPENING' ↙
'maxPSDdFILTEREDPUPILDIAMETER' 'maxPSDd2FILTEREDPUPILDIAMETER' 'prct5dECG' ↙
'prct5d2ECG' 'prct5dEYELIDOPENING' 'prct5d2EYELIDOPENING' ↙
'prct5dFILTEREDPUPILDIAMETER' 'prct5d2FILTEREDPUPILDIAMETER' 'prct25dECG' ↙
'prct25d2ECG' 'prct25dEYELIDOPENING' 'prct25d2EYELIDOPENING' ↙
'prct25dFILTEREDPUPILDIAMETER' 'prct25d2FILTEREDPUPILDIAMETER' 'prct75dECG' ↙
'prct75d2ECG' 'prct75dEYELIDOPENING' 'prct75d2EYELIDOPENING' ↙
'prct75dFILTEREDPUPILDIAMETER' 'prct75d2FILTEREDPUPILDIAMETER' 'prct95dECG' ↙
'prct95d2ECG' 'prct95dEYELIDOPENING' 'prct95d2EYELIDOPENING' ↙
'prct95dFILTEREDPUPILDIAMETER' 'prct95d2FILTEREDPUPILDIAMETER' 'Microsleep'};
3575 writetable(FeatureTable,'F:\Processed\FeatureTable.csv');
3576
3577
3578
```