

# COMPANION DEMOS

## DSP Programming – Demonstration Program 4

```
' FBankConsole - demonstrate application of filterbank to wav file
'
' Select a Console application.
'
' Use the "My Project" dialog to configure the program:
' - under the Compile tab, press "Advanced Compilation Options"
'   and change the Target CPU to "x86"
' - under the References tab, click the "Add" button then browse for
'   and select the BasicDSP.dll library.
'
' Run from Command Prompt or CYGWIN:
'   FBankConsole input.wav >output.txt
'
Imports BasicDSP
Imports BasicDSP.Filter
'
Module FBankConsole

    ' number of channels
    Private Const NCHAN As Integer = 19
    ' channel edge frequencies (Hz)
    Dim cutfreq() As Double = {180, 300, 420, 540, 660, 780, 900, 1075,
1225, 1375, 1525, 1700, 1900, 2100, 2300, 2550, 2850, 3150, 3475, 4000}
    ' output rate of filterbank (frames/sec)
    Private Const ORATE As Double = 100

    Sub Main(ByVal args() As String)
        Dim chan As Integer

        ' check arguments
        If args.Length = 0 Then
            Console.WriteLine("usage: fbankconsole input.wav")
            Environment.Exit(1)
        End If

        ' read in a WAV audio file
        Dim wv As New Signal
        If Not wv.LoadWaveFile(args(0)) Then
            Console.WriteLine("could not open file: " & args(0))
            Environment.Exit(1)
        End If

        ' build the bank of analysis filters
        Dim fbank(NCHAN) As LTISystemChain
        For chan = 1 To NCHAN
            fbank(chan) = ButterworthBandPass(cutfreq(chan - 1) / wv.Rate,
cutfreq(chan) / wv.Rate, 4)
        Next

        ' build a bank of smoothing filters at half output rate
        Dim sbank(NCHAN) As LTISystemChain
        For chan = 1 To NCHAN
            sbank(chan) = ButterworthLowPass((0.5 * ORATE) / wv.Rate, 4)
        Next
    End Sub
End Module
```

```

' process the signal sample by sample
Dim t As Double = 0
Dim out(NCHAN) As Double
For n As Integer = wv.First To wv.Last
    ' for each channel
    For chan = 1 To NCHAN
        ' filter the input sample
        out(chan) = fbank(chan)(wv(n))
        ' rectify
        out(chan) = Math.Abs(out(chan))
        ' smooth
        out(chan) = sbank(chan)(out(chan))
    Next
    t += wv.Period
    ' every so often, output frame
    If (t > 1 / ORATE) Then
        For chan = 1 To NCHAN
            Console.WriteLine("{0,6:F02} ", 20 * Math.Log10(out(chan)))
        Next
        Console.WriteLine()
        t -= 1 / ORATE
    End If
Next
End Sub

End Module

```

```

/cygdrive/c/src/vbasic/basicdsp/fbankconsole/bin/release
Mark@pc128-61 /cygdrive/c/src/vbasic/basicdsp/fbankconsole/bin/release
$ ./fbankconsole
usage: fbankconsole input.wav
Mark@pc128-61 /cygdrive/c/src/vbasic/basicdsp/fbankconsole/bin/release
$ ./fbankconsole c:/sfs/demo/six16000.wav
-10.91 -15.21 -18.23 -20.71 -22.49 -23.97 -16.83 -22.70 -25.24 -25.67 -20.73 -17
.81 -20.82 -22.97 -18.16 -16.88 -15.68 -13.71 -7.07
28.52 26.13 23.14 19.94 18.97 18.27 19.37 16.64 13.32 12.71 17.79 18
.91 13.89 11.61 15.72 15.06 15.56 16.29 19.87
32.92 32.47 29.36 26.65 24.51 24.84 23.60 21.15 29.99 22.00 22.56 24
.66 19.04 17.40 20.31 20.89 20.16 16.59 21.49
19.85 16.94 20.33 16.06 4.34 10.49 20.42 13.36 28.67 18.19 12.11 25
.72 19.69 19.08 23.37 21.02 18.56 17.87 21.44
25.82 24.92 20.98 15.60 18.24 13.63 20.61 19.93 1.54 21.20 17.70 12
.07 21.34 18.15 21.56 18.86 13.28 16.93 16.22
23.23 18.82 16.99 18.55 13.72 13.70 18.85 17.52 20.53 23.69 14.73 20
.35 22.34 16.86 16.52 15.70 10.30 18.84 19.45
26.22 13.72 19.71 19.39 17.10 12.61 21.52 16.10 15.00 15.40 11.07 15
.37 19.38 18.28 17.58 12.94 11.56 14.64 15.96
18.01 18.97 17.36 10.17 11.98 8.20 5.51 16.57 22.19 15.89 16.00 13
.22 14.30 11.31 18.08 14.33 10.49 16.65 20.02
27.40 18.04 15.17 20.32 10.49 15.27 18.17 13.44 16.51 22.34 16.83 17

```