

COMPILING AND RUNNING THE PROGRAMS

DSP Programming – Demonstration Program 6

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' DemoAnal - Demonstrate fx and formant frequency estimation
',
' Create a form with a button and two read-only text boxes
' as shown overleaf.
',
' 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.
',
Imports BasicDSP
Public Class DemoAnal
    Const SAMPRATE As Double = 11025.0      ' sampling rate
    Dim wv As New Signal(SAMPRATE, SAMPRATE)
    ' pre-emphasise a speech signal
    Function PreEmphasise(ByVal iwv As Waveform) As Waveform
        Dim owv As New Waveform(iwv.Count, iwv.Rate)
        For i As Integer = iwv.First To iwv.Last
            owv(i) = iwv(i + 1) - 0.95 * iwv(i)
        Next
        Return owv
    End Function
    ' perform sampling and calculate speech parameters
    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
        ' grab a short sample of audio
        wv.RecordStart(5000)
        wv.RecordWait()
        wv.RecordDone()
        wv = wv.Cut(1, 2048)
        ' Calculate its spectrum
        Dim y As Spectrum = DFT.ComplexDFT(Window.Hamming(wv.Float.Complex))
        ' copy the log spectrum into a waveform
        Dim cy As New ComplexWaveform(y.Count, y.Rate)
        For i As Integer = 0 To y.Count
            cy(i + 1) = Math.Log10(y(i).Mag)
        Next
        ' calculate the cepstrum
        Dim c As Spectrum = DFT.ComplexDFT(cy)
        ' search between 50 & 500Hz
        Dim ms1 As Integer = 0.002 * c.Rate
        Dim ms20 As Integer = 0.02 * c.Rate
        ' find the peak
        Dim maxval As Double = c(ms1).Mag
        Dim fx As Double = c.Rate / ms1
        For i As Integer = ms1 To ms20
            If (c(i).Mag > maxval) Then
                maxval = c(i).Mag
                fx = c.Rate / i
            End If
        Next
        TextBox1.Text = fx.ToString("F00")
        ' calculate an LP model
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Dim pe As Double
Dim np As Integer = wv.Rate / 1000
Dim pc As LTISystem = LPC.Auto(PreEmphasise(wv.Float), np, pe)
' get roots of filter polynomial
Dim roots() As Complex = Roots.FindRoots(pc.b, np)
' display formant frequencies
Dim msg As String = ""
For i As Integer = 1 To np
    ' calculate frequency & bandwidth of each pole
    Dim f As Integer = Math.Atan2(roots(i).Imag, roots(i).Real) *
wv.Rate / (2 * Math.PI)
    Dim b As Integer = Math.Abs(Math.Log(roots(i).Mag)) * wv.Rate
/ (2 * Math.PI)
    ' include if it looks like a formant
    If (f > 100) And (f < 4000) And (b < 300) Then
        msg = msg & f.ToString("F00") & " "
    End If
Next
TextBox2.Text = msg
End Sub
End Class

```

