

OCR Robot Coding Notes

MUCH2020 Studio

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2020. 02.24

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Software idea and target

1. Visual Studio work with Halcon operators;
2. Connected with 2D camera for OCR for handwrite letters and print letters, for civil and industry use;
3. Adjustment is fully flexible for user;
4. Adjustment parameters can be save and loaded project by project, for large OCR volume operation, including OCR classifier, picture segment, character region choose, manual and automatic OCR;
5. ShapeModel function for system to automatically capture region for OCR;
6. OCR classifier can be uploaded by user;
7. More OCR classifier will be uploaded periodically by MUCH2020 Studio.

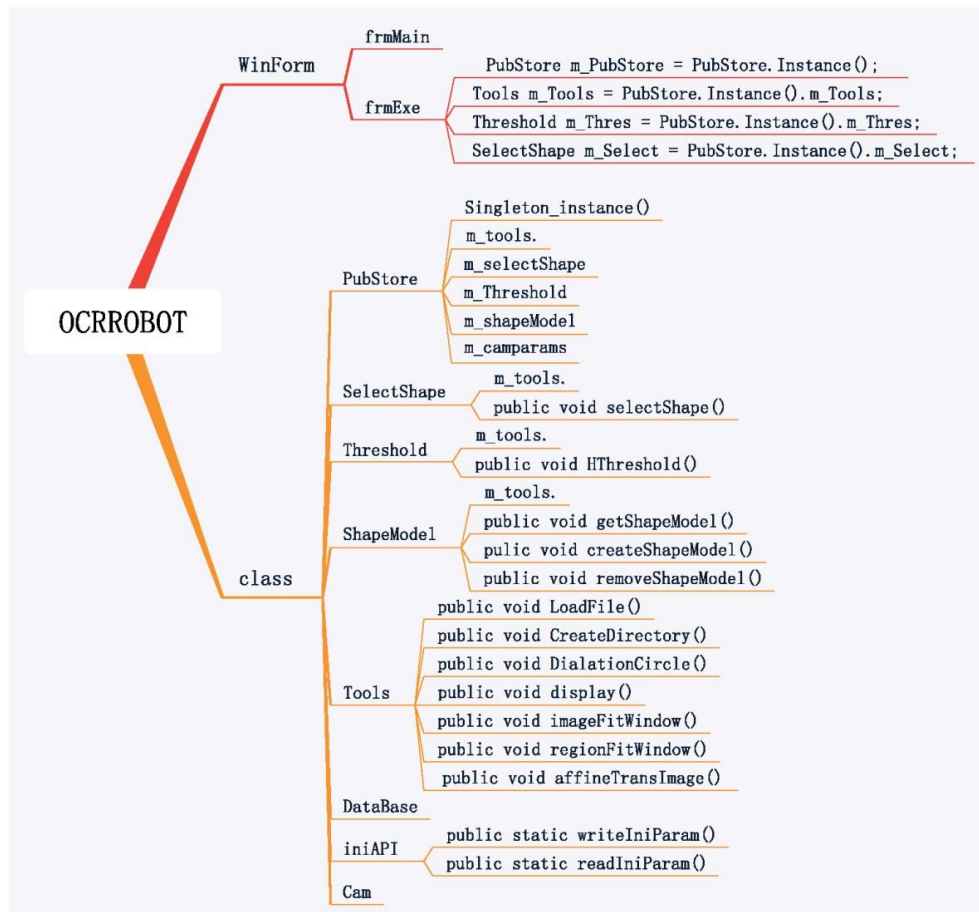
UI Introduction

For UI info, please check "[OCR Robot Manual](#)".

C# Code Introduction

Architecture

Class



Singleton Pattern

For class `PubStore`

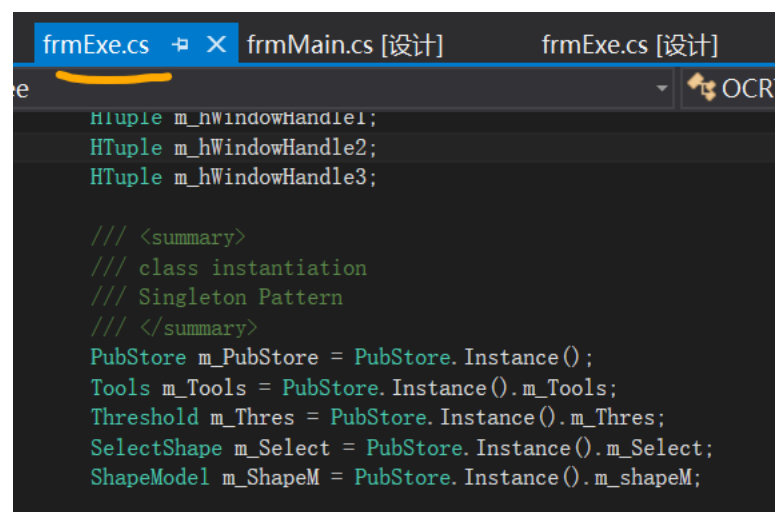
```
#region PubStore Singleton

    private static PubStore _instance = null;

    public static PubStore Instance()
    {
        if (_instance == null)
        {
            _instance = new PubStore();
        }
        return _instance;
    }
#endregion

    /// <summary>
    /// PubStore Singleton Pattern
    /// </summary>
    public Tools m_Tools = new Tools();
    public CamParam m_camParam = new CamParam();
    public Threshold m_Thres = new Threshold();
    public SelectShape m_Select = new SelectShape();
    public ShapeModel m_shapeM = new ShapeModel();
```

Under `frmExe`



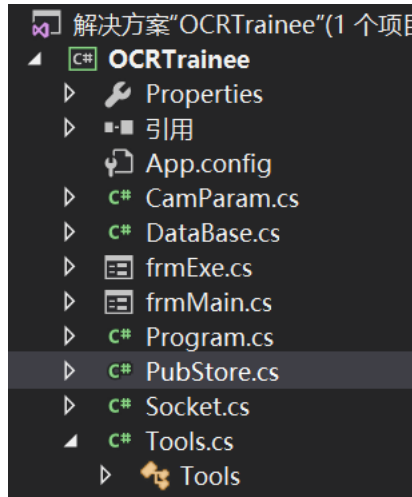
```
frmExe.cs  frmMain.cs [设计]  frmExe.cs [设计]
e
Htuple m_hWindowHandle1;
HTuple m_hWindowHandle2;
HTuple m_hWindowHandle3;

    /// <summary>
    /// class instantiation
    /// Singleton Pattern
    /// </summary>
    PubStore m_PubStore = PubStore.Instance();
    Tools m_Tools = PubStore.Instance().m_Tools;
    Threshold m_Thres = PubStore.Instance().m_Thres;
    SelectShape m_Select = PubStore.Instance().m_Select;
    ShapeModel m_ShapeM = PubStore.Instance().m_shapeM;
```

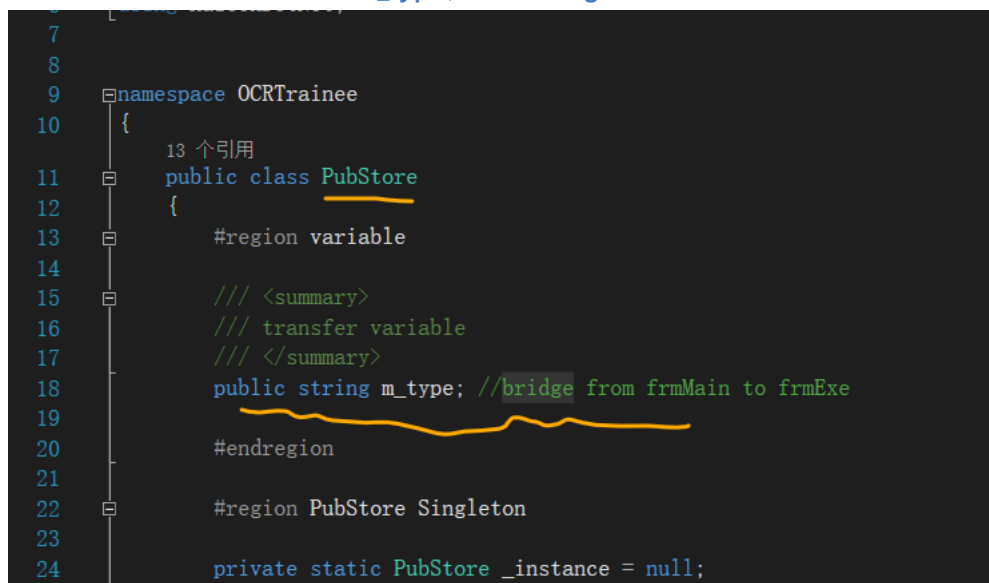
Cross WinForm delivery

Steps:

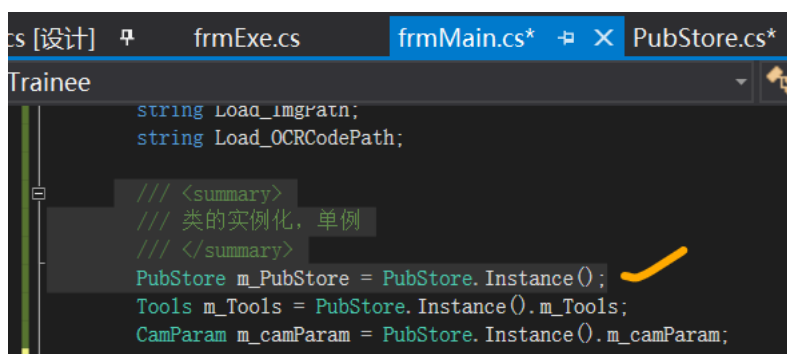
1. Create a public class, name as "PubStore"



2. Make a transfer variable `m_type`, and a `singleton`



3. Under frmMain, make class `PubStore` instantiation with `singleton`



4. Steps of this transfer variable running-----m_PubStore.m_type

frmMain

OCR ROBOT

The screenshot shows the 'frmMain' application window for 'OCR ROBOT'. The interface is organized into several functional areas:

- Camera Section:** Contains four buttons: 'Grab_Img', 'Close Cam', 'Master_Img', and 'Save_Img'. Below these is a text input field for 'Expo (us)' and a horizontal slider control.
- New OCR Section:** Includes a text input field containing 'HL01' and a 'New Story' button.
- Project Section:** Features a list box with the following items: 'Bottle', 'Final01', 'HL01' (which is currently selected), and 'PLettSh'. To the right of the list box are four buttons: 'Load_Story' (circled in yellow), 'Remove_Story', 'Exe_Window', and 'Reboot'. Below the list box is another text input field containing 'HL01'.
- Status Section:** A label 'Status' is positioned below the 'HL01' input field in the Project section.
- Image Display Area:** On the right side of the window, there is a large vertical area with two tabs at the top: 'ImageGrad' and 'VisionScrip'. The area below the tabs is mostly dark, suggesting a video feed or image processing output.

```
frmMain.cs*  Tools.cs  frmExe.cs  frmMain.cs [设计]*  frmExe.cs [设计]  frmExe.Designer.c
OCRTrainee  OCRTrainee.frmMain  btnLoadType_Click
104 窗体控件等比大小缩放 WinForm controls Resize
105
157
158 #region Load Story 加载项目click事件 Load Story click/Story choose
1 个引用
159 private void btnLoadType_Click(object sender, EventArgs e)
160 {
161     try
162     {
163         tb_type.Text = listBox1.SelectedItem.ToString();
164         txType.Text = listBox1.SelectedItem.ToString();
165
166     #region //loading masterimage path
167     Load_ImgPath = StrPath + "\\\" + "Proj" + "\\\" + tb_type.Text + "\\\" + "Image";
168     // 读双目图片 (显示)
169     // 判断图像是否为空
170
171     if ((File.Exists(Load_ImgPath + "\\\" + "masterimage.bmp")))
172     {
173         HOperatorSet.GenEmptyObj(out m_Image); 已用时间 <= 1ms
174         m_Image.Dispose();
175         HOperatorSet.ReadImage(out m_Image, Load_ImgPath + "\\\" + "masterimage.bmp");
176         m_Tools.Imshow(m_Image, m_hWindowHandle3, m_Image);
177     }
178 }
```

```
frmMain.cs*  Tools.cs  frmExe.cs  frmMain.cs [设计]*  frmExe.cs [设计]  frmE
OCRTrainee  OCRTrainee.frmMain  btn
181     MessageBox.Show("Image invalid!");
182 }
183
184 #endregion
185
186 #region //loading halcon code .txt file in WindowHandle III
187 Load_OCRCODEPath = StrPath + "\\\" + "Proj" + "\\\" + tb_type.Text + "\\\" + "Co
188 //read Halcon or OpenCV .txt code, and showup in WindowHandle III, "VisionSri
189 //but this function is optional. if no .txt file saved by user, then no showu
190 string s;
191 string txtCodePath = Load_OCRCODEPath + "\\HCode.txt";
192 //ReadStream
193 m_Tools.ReadStream(ref txtCodePath, out s);
194 richTextBox1.Text = s.ToString();
195 #endregion
196
197 m_PubStore.m_type = tb_type.Text; //transfer string vairalbe
198
199 } 已用时间 <= 1ms
200 catch
201 {
```


frmExe:

Master_Img Save_Img

Expo (us)

New OCR

HL01 New Story

Project

Bottle
Final01
HL01
PlettSh

Load_Story

Remove_Story

Exe_Window

Reboot

HL01 Status

```

frmMain.cs frmExe.cs  frmMain.cs [设计]  frmExe.cs [设计]  frmExe.Designer.cs  iniA
OCRTrainee  OCRTrainee.frmExe  frmExe()

605  #endregion
606
607  Rotate Image if image text line has a degree
625
626  Execution OCR
738
739  /// <summary>
740  /// 构造函数
741  /// 把图片文件夹与代码文件夹写入
742  /// </summary>
743  1 个引用
743  public frmExe()
744  {
745      InitializeComponent();
746      m_Exetype = m_PubStore.m_type; //中间变量从frmMain传入
747      load_imagePath = StrPath + "\\ " + "Proj" + "\\ " + m_Exetype + "\\Image"; //图片文件夹 已用时间 <= 1ms
748      load_codePath = StrPath + "\\ " + "Proj" + "\\ " + m_Exetype + "\\Code"; //代码文件夹, story分类器文件夹
749      load_handlePath = StrPath + "\\ " + "Proj" + "\\ " + m_Exetype + "\\OCRHandle"; //story工作的分类器文件夹
750
751      load_classifPath = StrPath + "\\ " + "Classifier"; //系统全部分类器
752
753  }

```

transfer

```
frmMain.cs  Tools.cs  frmExe.cs  frmMain.cs [设计]  frmExe.d
C# OCRTrainee  OCRTrainee.frmMain

256      /// <summary>
257      /// sub windowForm for masterimage OCR detail operation
258      /// after operation save story and ready for loading for volume
259      /// Open frmExe
260      /// </summary>
261      /// <param name="sender"></param>
262      /// <param name="e"></param>
263      1 个引用
264      private void button2_Click(object sender, EventArgs e)
265      {
266          try
267          {
268              frmExe m_frmExe = new frmExe(); 已用时间 <= 1ms
269              m_frmExe.Show();
270          }
271          catch
272          {
273          }
274      }
275
276  }
```

frmMain

New OCR

listBox1

Project

Status

New Story

Load_Story

Remove_Story

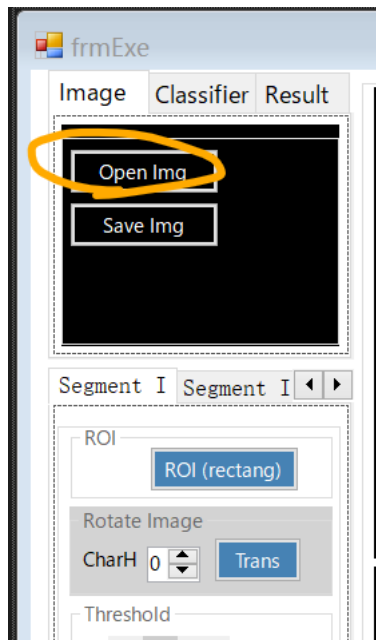
Exe_Window

Reboot

frmExe

This is the execution winform for detail OCR operation.

Open image---m_Image



```
private void btnOpenImage_Click(object sender, EventArgs e)
{
    ofdImage.Filter = "(*.bmp;*.png;*.jpg;*.jpeg;*.tif)|*.bmp;*.png;*.jpg;*.tif";
    ofdImage.Multiselect = false;
    if (ofdImage.ShowDialog() == DialogResult.OK)
    {
        try
        {
            HOperatorSet.GenEmptyObj(out m_Image);
            m_Image.Dispose();
            HOperatorSet.ReadImage(out m_Image, ofdImage.FileName);

            m_Tools.Imgshow(m_Image, m_hWindowHandle1, m_Image);
        }
        catch (Exception)
        {
            MessageBox.Show("Image Invalid!");
        }
        finally
        {
            ofdImage.Dispose();
        }
    }
}
```

Then get new m_Image.

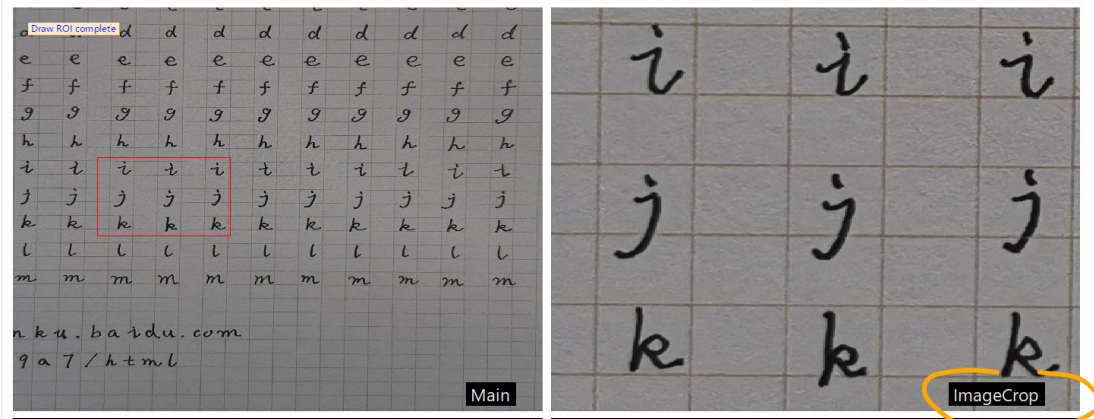
Halcon code accordingly

```
1 .ui_pau
8 TrainFile := FontName+'Training.trf'
9 read_image (Image1,FontName+'train8.bmp') ✓
```

ImageCropped for Display

ImageReduced is for real execution for OCR, and ImageCropped is only for display on the big windowHandle.

Example for ROI button



```
#region ROI rectangular
1 个引用
private void button5_Click(object sender, EventArgs e)
{
    try
    {
        HOperatorSet.GenEmptyObj(out m_Region);
        HOperatorSet.GenEmptyObj(out m_imageReduced);
        HOperatorSet.GenEmptyObj(out m_imageCropped);
        m_Region.Dispose();
        m_imageReduced.Dispose();
        m_imageCropped.Dispose(); //display for windowHandle2

        m_Tools.DrawRectangel(hWindowControl1, m_Image, m_hWindowHandle1, ref m_Region, ref m_imageReduced, ref m_imageCropped);
        m_Tools.ImageFitWindow(m_imageCropped, m_hWindowHandle2); //display for windowHandle2
        m_Region.Dispose();

        //Show execute result
        label1.Text = "ROI done";
    }
    catch
    {
    }
}
#endregion
```

Appendix

Halcon Code Example

OCR Story: PrintLetter

Create OCR TrainingDocument

a	a	a	a	a	a	a	a	a	a	a	a
b	b	b	b	b	b	b	b	b	b	b	b
c	c	c	c	c	c	c	c	c	c	c	c
d	d	d	d	d	d	d	d	d	d	d	d
e	e	e	e	e	e	e	e	e	e	e	e
f	f	f	f	f	f	f	f	f	f	f	f
g	g	g	g	g	g	g	g	g	g	g	g
h	h	h	h	h	h	h	h	h	h	h	h

...

A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D
E	E	E	E	E	E	E	E	E	E
F	F	F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H	H	H
I	I	I	I	I	I	I	I	I	I
J	J	J	J	J	J	J	J	J	J
K	K	K	K	K	K	K	K	K	K
L	L	L	L	L	L	L	L	L	L
M	M	M	M	M	M	M	M	M	M
N	N	N	N	N	N	N	N	N	N
O	O	O	O	O	O	O	O	O	O

...

,	,	,	,	,	,	,	,	,	,
!	!	!	!	!	!	!	!	!	!
—	—	—	—	—	—	—	—	—	—
,	,	,	,	,	,	,	,	,	,
-	-	-	-	-	-	-	-	-	-

...

** -----

Use `append_ocr_trainf()` collect more and more letters into training file

```

68
69 *TrainingFileName
70 TrainingFileName := FontName + 'Training.trf'
71 sort_region (RegionIntersection, Characters, 'character', 'true', 'row')
72 shape_trans (Characters, RegionTrans, 'rectangle1')
73 area_center (RegionTrans, Area, Row, Column)
74 for I := 0 to |Classes|-1 by 1
75   select_obj (Characters, CharaterRegions, I+1)
76   shape_trans (CharaterRegions, RegionTrans, 'rectangle1')
77   area_center (RegionTrans, Area, Row, Column)
78   append_ocr_trainf (CharaterRegions, Image, Classes[I], TrainingFileName) ✓
79   disp_message (WindowHandle, Classes[I], 'image', Row, Column, 'blue', 'true')
80 endfor
81 stop()
82
83 * Create the classifier. We read out the classes from the train file.
84 * Therefore, the training part of the program is generic and can be
85 * used to train any OCR classifier.
86 *读入TrainFile, 为训练做准备
87 read_ocr_trainf_names (TrainingFileName, CharacterNames, CharacterCount)
88 *利用MLP (多层感知器) 创建一个新的OCR分级器
89 * NumHidden 隐藏层20层
90 create_ocr_class_mlp (8, 10, 'constant', 'default', CharacterNames, 20, 'normalization', 26, 42, OCRHandle)
91 * Train the classifier 训练分类器
92 trainf_ocr_class_mlp (OCRHandle, TrainingFileName, 100, 0.01, 0.01, Error, ErrorLog)
93 TrainingDocument:=FontName+'Classifier.omc'
94 write_ocr_class_mlp (OCRHandle, TrainingDocument)
95 stop ()
96 *****

```

So the training file including a to z, A to Z, and

.	.	.
,	,	,
!	!	!
—	—	—
'	'	'
-	-	-

Classifier Sample

a	A	b	B	c	C
d	D	e	E	f	F
k	K	l	L	ll	M
...					

For more info of *.trf pls see code uploaded

Do OCR

* Now test the classifier on the whole training image

*Prepare

FontName := 'E:/Halcon/OCR/OCRRobot1/'

*.trf _path

*TrainFile := FontName+'Training.trf'

dev_update_off ()

dev_get_window (WindowHandle)

*Read image

*ROI

read_image (Image1,FontName+'train8.bmp')

gen_rectangle1 (ROI_0, 960.708, 866.167, 1509.97, 2386.17)

reduce_domain (Image1, ROI_0, ImageReduced)

* Segment characters the same way as before---1.threshold or 2.further select_shape

*****option1 just get Region directly

*binary_threshold (ImageReduced, Region, 'max_separability', 'dark', UsedThreshold1)

threshold (ImageReduced, Region, 0, 100)

*****option2 also get Region

connection (Region, ConnectedRegions)

select_shape (ConnectedRegions, SelectedRegions, 'area', 'and', 127.49, 5000)

union1 (SelectedRegions, Region)

**Dilation

dilation_circle (Region, RegionDilation, 5.5)

connection (RegionDilation, ConnectedRegions)

intersection (ConnectedRegions, Region, RegionIntersection)

sort_region (RegionIntersection, Characters, 'character', 'true', 'row')

**show sort region result

count_obj (Characters, Number)

for i:=1 to Number by 1

 select_obj (Characters, ObjectSelected_i, i)

 area_center (ObjectSelected_i, Area_i, Row_i, Column_i)

 disp_message (WindowHandle, i, 'image', Row_i+60, Column_i, 'black', 'true')

endfor

* Classification

**read OCRHandle from file

read_ocr_class_mlp (FontName+'KenHLet01.omc', OCRHandle)

**do OCR

do_ocr_multi_class_mlp (Characters, Image1, OCRHandle, Class, Confidence)

* Display results

area_center (Characters, Area, Row, Column)

dev_display (Image1)

set_display_font (WindowHandle, 16, 'sans', 'true', 'false')

disp_message (WindowHandle, Class, 'image', Row + 36, Column + 8, 'blue', 'false')

*set_display_font (WindowHandle, 16, 'mono', 'true', 'false')

disp_message (WindowHandle, 'Classification done', 'window', 12, 12, 'black', 'true')

