Pattern Matching Using IMAQ Vision

Objectives:

- To program a machine vision application that can snap an image and perform a useful measurement.
- To select a region of interest in an image and apply pattern matching techniques in IMAQ Vision Builder.

Procedure A: Region of Interest [9.1][1]

1. Launch LabVIEW and click **Open New VI**.

2. Create an image buffer with IMAQ Create (**Motion & Vision>>Vision Utilities>>Image Management**).

3. Add a string constant to the **Image Name** input. Enter "`My Image`" as your constant.

4. Add IMAQ Snap to your diagram.

5. Add IMAQ Select Rectangle (**Machine Vision>>Select Region of Interest**) and IMAQ Clamp Horizontal MAX (**Machine Vision>>Measure Distances**).

6. Add IMAQ WindDraw and IMAQ General Error Handler.

7. Wire the Rectangle output on the IMAQ Select Rectangle VI to the Rectangle input on the IMAQ Horizontal Clamp VI.

8. Add an indicator to IMAQ Clamp Horizontal Max to display the measured distance. Complete the remaining wiring as shown in Figure 1.

9. Run the VI.

10. Snap an image of an object featuring a straight edge (such as a business card).

11. Select an appropriate rectangular region of interest to measure the distance from the left edge to the right edge and select **OK**.

12. Check the distance measurement on the front panel of the VI.

[1] Numbers in square brackets such as [9-1] refer to exercises in the LabVIEW™ Machine Vision and Image Processing Course Manual by National Instruments.

13. Save the VI as "`Region of Interest .VI`".

Exercise: Experiment with different scenarios by replacing IMAQ Select Rectangle with a different shape. Note that you must also change IMAQ Clamp Horizontal Max to a VI that corresponds to the ROI shape you select.

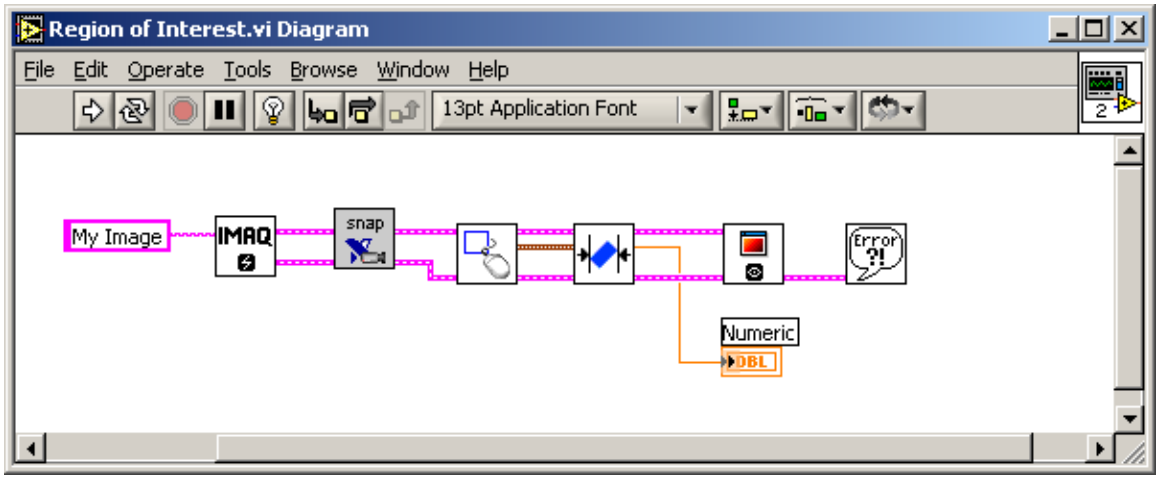

Fig. 1

Procedure B: Pattern Matching [9.2]

1. Launch IMAQ Vision Builder

2. Select **Acquire Image**. Use the **Snap** and **Grab** buttons to acquire a series of images of an object you would like to use in pattern matching. As you acquire images, rotate the image acquisition device and move it around to get images that are slightly different. You may also wish to adjust the aperture on your camera lens to simulate a change in lighting.

3. Acquire six to eight images and store them in the image browser.

4. When you are finished, click **Return**. The image browser opens, displaying the images you stored.

5. Save these images for use later in the lab.
   - Go to the **File** menu and choose **Save Image**.
   - Select **All images** under **Image Selection**.
   - Set the directory to **Desktop** and set the file name to `source`.
   - Click **Save**. Several image files are now located on your desktop. You will use those files later in this lab.

6. Double-click the first image in the image browser. This image opens in the main IMAQ Vision Builder window.

7. Select **Pattern Matching** from the **Machine Vision** menu.

8. Select **Shift and Rotation** from the **Learn Mode** drop-down menu. This selection determines the Search Mode options you have available for your search. For example, if you selected **Learn Mode** as **Shift Only**, you would later be able to search for your pattern using only **Shift Invariant** and not **Rotation Invariant**.

9. Draw a box around the pattern you want to find in all of your images. In the attached image (Figure 2), there is a box drawn around the bracket's top left corner.

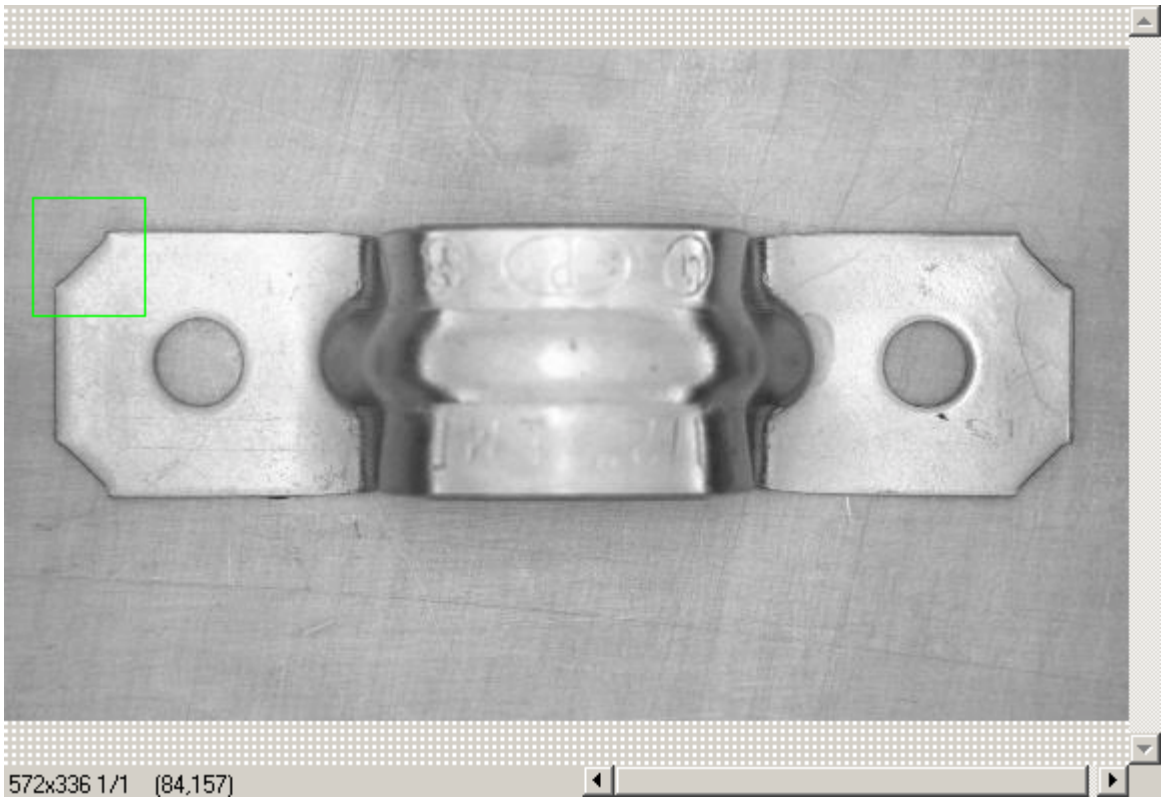

Fig. 2

10. Click on **Create from ROI**. IMAQ Vision Builder indicates that it is learning the template pattern and asks you where to save the template.

11. Save the template to your desktop and name the file "template.png". PNG files are one of the file formats IMAQ Vision uses to store images.

12. Click on **Search Template** to match this template pattern in each of your images. The lower portion of the window should look like the attached image (Figure 3).

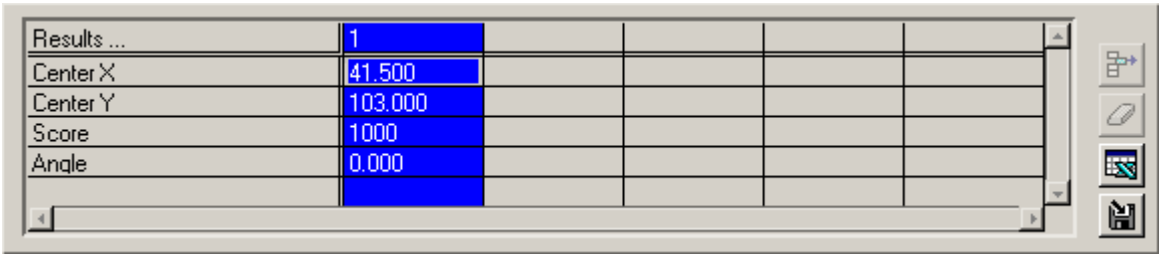

Fig. 3

13. Change the search mode to **Rotation Invariant** and click on **Search**. If you did not set your learn mode to **Shift and Rotation**, this option is grayed out. The table under the image window describes where each match was found, the score of the match (where the score of 1000 represents a perfect match), and the angle of rotation of the pattern. A green square highlights the pattern. If you do not see the pattern, use the scrollbars to the right and to the bottom of the image to display it in the window. Try using the pattern-matching functions on different images. To change the active image in IMAQ Vision Builder, first click on Next Image and then click on Make Image Active (beneath the thumbnail image in the upper left portion of the window). The first button allows you to look at all of the images in the browser, one by one. The second button makes the thumbnail image active so that you can apply this processing step to it.

14. Test the pattern match on all of the images in your browser. Take note of the score for each match and how the score is affected by changes in rotation or lighting. If you have an image in which the pattern is not found, try lowering the **Minimum Score** to 500 and clicking **Search**. As you lower the score, IMAQ Vision Builder finds the pattern, unless it is hanging off the edge of the image or if it is a different size from the original pattern.

15. When you are finished, click on **Apply** and **Close**.

16. Create a LabVIEW VI from this IMAQ Vision Builder script using either the Builder File or selecting **Script>>Create LabVIEW VI**.

17. Save your VI as `Pattern Matching in LabVIEW.vi`. Examine the File Path Control on the front panel of the VI. This control determines the path of the pattern you are matching. Notice that it is automatically assigned the location of the pattern you saved in IMAQ vision Builder.

18. Run the VI. At the file prompt, enter the path for one of the images you previously saved.

19. Check the score from the Matches indicator to see how well your pattern matched the image.

20. Examine IMAQ Setup Match Pattern and IMAQ Match Pattern VIs using the popup help menu.

21. Replace IMAQ Match Pattern with IMAQ Find Pattern.

    - Right-click on IMAQ Match Pattern and select **Replace>>Motion & Vision>>Machine Vision>>Find Pattern**.
    - Delete IMAQ Setup Match Pattern and any broken wires or unwired constants.
    - Create a control for IMAQ Find Pattern. On the control panel, set this control to **Rotation Invariant**, set the number of matches to **1**, and check **Draw Result**. IMAQ Find Pattern is a high-level IMAQ Vision VI that learns your template image, if it is not already learned, and then draws boxes around any matches.

22. Run the VI again. Notice the boxes drawn around the matched patterns.

23. Close the VI.