11

OBJECT TRACKING BASED ON HSL COLOR IMAGE FILTERING USING CAMERA

Pada pokok bahasan ini, mahasiswa akan mengaplikasikan HSL color filtering untuk mendeteksi dan mentracking objek secara real time menggunakan kamera.

Pokok Bahasan :

1. Traking objek menggunakan HSL Color Filter

Latihan:

2. Membuat aplikasi tracking objek menggunakan HSL color filter secara *real time*

11.1. **Aforge.Video** dan **Aforge.Video.DirectShow**

Capaian pembelajaran: memahami dan mengaplikasikan HSL color filter untuk mentraking objek bergerak yang terkapture camera.

Pada dasarnya penggunaan Color filter pada objek bergerak sama dengan penggunaannya pada objek diam (citra). Perbedaannya hanya terletak pada input yang akan diolah. Untuk tracking objek bergerak maka input bisa berasal dari video yang sudah terekam maupun objek yang secara real time tercapture oleh kamera..

Beberapa kelas yang diberikan diantaranya

1. **FilterInfoCollection** merupakan kelas yang berisi koleksi informasi dari filter untuk mencari informasi tentang kamera
2. **VideoCaptureDevice** merupakan kelas yang menyatakan sumber video dari mana video itu berasal misal USB kamera
3. **VideoCapabilities** merupakan kelas yang menunjukkan kemampuan video capture (USB kamera dalam menentukan property dari video seperti frame size, frame rate dll.

11.2. Latihan

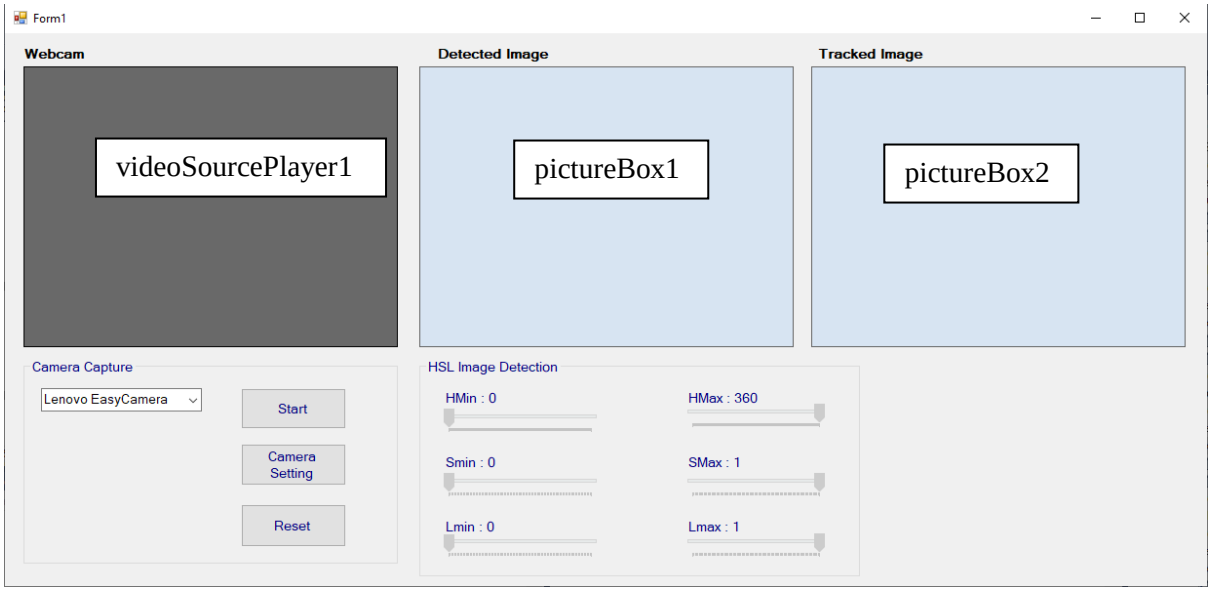
Tujuan

Memahami penggunaan AForge.NET dan mengaplikasikannya dalam mentraking objek bergerak dengan kamera menggunakan HSL color filtering.

Prosedur

1. Tambahkah projek baru
2. Tambahkan library **AForge.dll, AForge.Control.dll, AForge.Imaging.dll, AForge.Math.dll, AForge.Video.dll** dan **AForge.Video.DirectShow.dll** pada menu **References**

3. Tambahkan beberapa dengan **Toolbox** pada form anda sehingga menjadi seperti gambar berikut:



4. Tambahkan library berikut pada program anda :

```
using AForge;
using AForge.Imaging;
using AForge.Imaging.Filters;
using AForge.Video;
using AForge.Video.DirectShow;
using System.Collections;
```

5. Tambahkan global variable sebagai berikut :

```
private FilterInfoCollection videoDevices;
private VideoCaptureDevice videoDevice;
private ArrayList listCamera = new ArrayList();

//image variabel
Bitmap sourceImage = null;
Bitmap detectedImage = null;

//trackbar variable
int Hmin, Hmax;
float Smin, Smax, Lmin, Lmax;
int TRACK_SPACE = 2;
```

6. Tambahkan fungsi **`trackBarEnable(); trackBarReset(); dan labelReset();`** di bawah **`InitializeComponent();`**

```
public Percobaan11()
 {
     InitializeComponent();

     trackBarEnable(false);
     trackBarReset();
     labelReset();
 }
```

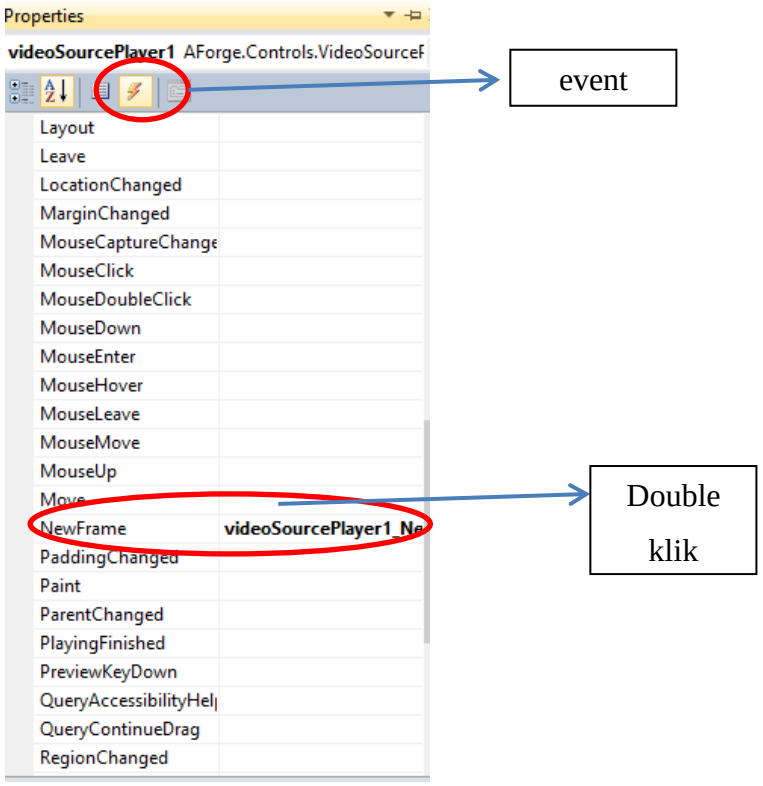
7. Tambahkan juga fungsi berikut ini :

```
//RGB trackbar Enable
 private void trackBarEnable(bool enable =true)
 {
     //HSL trackbar Enable
     trackBarHmax.Enabled = enable;
     trackBarHmin.Enabled = enable;

     trackBarSmax.Enabled = enable;
     trackBarSmin.Enabled = enable;

     trackBarLmax.Enabled = enable;
     trackBarLmin.Enabled = enable;

 }

private void trackBarReset()
 {
    //HSL tracbar init
     trackBarHmax.Maximum = 360;
     trackBarHmin.Maximum = 360;

     trackBarSmax.Maximum = 100;
     trackBarSmin.Maximum = 100;

     trackBarLmax.Maximum = 100;
     trackBarLmin.Maximum = 100;

     //HSL trackbar reset
     trackBarHmax.Value = 360;
     trackBarHmin.Value = 0;

     trackBarSmax.Value = 100;
     trackBarSmin.Value = 0;

     trackBarLmax.Value = 100;
     trackBarLmin.Value = 0;

     Hmin = trackBarHmin.Value;
     Hmax = trackBarHmax.Value;
     Smin = (float)trackBarSmin.Value/100;
     Smax = (float)trackBarSmax.Value/100;
     Lmin = (float)trackBarLmin.Value/100;
     Lmax = (float)trackBarLmax.Value/100;
 }

 private void labelReset()
 {
     //HSL label reset
     labelHmax.Text = string.Format("HMax : {0}", Hmax);
     labelHmin.Text = string.Format("HMin : {0}", Hmin);

     labelSmax.Text = string.Format("SMax : {0}", Smax);
     labelSmin.Text = string.Format("Smin : {0}", Smin);

     labelLmax.Text = string.Format("Lmax : {0}", Lmax);
     labelLmin.Text = string.Format("Lmin : {0}", Lmin);
 }
```

8. Tambahkan fungsi-fungsi berikut untuk membuka dan menutup video source:

```
// usb camera definition
private static string _usbcamera;
public string usbcamera
{
    get { return _usbcamera; }
    set { _usbcamera = value; }
}

// opening the video source
private void OpenVideoSource(IVideoSource source)
{
 try
 {
     // set busy cursor
     this.Cursor = Cursors.WaitCursor;

     // stop current video source
     CloseCurrentVideoSource();

     // start new video source
     videoSourcePlayer1.VideoSource = source;
     videoSourcePlayer1.Start();

      this.Cursor = Cursors.Default;
 }
 catch { }
}

// closing the video source
public void CloseCurrentVideoSource()
{
    try
    {
        if (videoSourcePlayer1.VideoSource != null)
        {
            videoSourcePlayer1.SignalToStop();

            // wait ~ 3 seconds
            for (int i = 0; i < 30; i++)
            {
                if (!videoSourcePlayer1.IsRunning)
                    break;
                System.Threading.Thread.Sleep(100);
            }

            if (videoSourcePlayer1.IsRunning)
            {
                videoSourcePlayer1.Stop();
            }

            videoSourcePlayer1.VideoSource = null;
        }
    }
    catch { }
}
```

9. Untuk mengcapture frame meggunakan kamera, tambahkan program berikut dengan **meng-klik kanan** `videoSourcePlayer1`➔properties➔event. Double klik **NewFrame**. Dan tambahkan program berikut :




```
private void videoSourcePlayer1_NewFrame(object sender, ref Bitmap image)
 {
     try
     {
       sourceImage = image.Clone() as Bitmap;

      //detect the image
      colorFiltering(sourceImage);

      //traking the image
      objectTracking(sourceImage);

     }
     catch
     {

     }
 }
```

10. Tambahkan fungsi berikut untuk ***filter*** dan ***object tracking*** :

```
private void colorFiltering(Bitmap srcImage)
{
    // create HSL filter
    HSLFiltering filter = new HSLFiltering();

    // set color ranges to keep
    filter.Hue = new IntRange(Hmin, Hmax);
    filter.Saturation = new Range(Smin, Smax);
    filter.Luminance = new Range(Lmin, Lmax);

    // apply the filter
    detectedImage = filter.Apply(srcImage);

    //draw the picture
    pictureBox1.Image = detectedImage;
}

private void objectTracking(Bitmap srcImage)
{
    if (srcImage == null || detectedImage == null) return;

    //copy detected image to the new one
    Bitmap newImage = (Bitmap)detectedImage.Clone();

    //blob counter on the detected image
    BlobCounter bc = new BlobCounter();
    bc.MinHeight = 20;
    bc.MinWidth = 20;
    bc.FilterBlobs = true;
    bc.ObjectsOrder = ObjectsOrder.Area;
    bc.ProcessImage(newImage);
    Rectangle[] rects = bc.GetObjectsRectangles();
    foreach (Rectangle recs in rects)
    {
        if (rects.Length > 0)
        {
            Rectangle objectRect = rects[0];

            Graphics graph = Graphics.FromImage(srcImage);
            using (Pen pen = new Pen(Color.FromArgb(255, 0, 0), 10))
            {
                graph.DrawRectangle(pen, objectRect);
            }
            graph.Dispose();
        }
    }
    //draw tracked object on picture box
    pictureBox2.Image = srcImage;
}
```

11. Tambahkan fungsi berikut untuk open camera:

```
        private void OpenCamera()
        {
            try
            {
                usbcamera = comboBox1.SelectedIndex.ToString();
             videoDevices = new FilterInfoCollection(FilterCategory.VideoInputDevice);

                if (videoDevices.Count != 0)
                {
                    // add all devices to combo
                    foreach (FilterInfo device in videoDevices)
                    {
                        listCamera.Add(device.Name);
                    }
                }
                else
                {
                    MessageBox.Show("Camera devices found");
                }

                videoDevice = new
VideoCaptureDevice(videoDevices[Convert.ToInt32(usbcamera)].MonikerString);

                OpenVideoSource(videoDevice);
            }
            catch (Exception err)
            {
                MessageBox.Show(err.ToString());
            }
        }
```

12. **Double klik** button **Start** dan tambahkan program berikut :

```
            private void button1_Click(object sender, EventArgs e)
            {
                OpenCamera();
               trackBarEnable();
            }
```

13. **Double klik** **Form** dan tuliskan sub rutin program berikut :

```
       private void Form1_Load(object sender, EventArgs e)
        {
            videoDevices = new FilterInfoCollection(FilterCategory.VideoInputDevice);

            if (videoDevices.Count != 0)
            {
                // add all devices to combo
                foreach (FilterInfo device in videoDevices)
                {
                    comboBox1.Items.Add(device.Name);
                }
            }
            else
            {
                comboBox1.Items.Add("No DirectShow devices found");
            }
            comboBox1.SelectedIndex = 0;
       }
```

14. **Right klik** **Form** dan tambahkan rutin berikut :

```
private void Form1_FormClosed(object sender, FormClosedEventArgs e)
 {
     if (videoCap != null && videoCap.IsRunning)
         videoCap.Stop();
 }
```

15. **Double klik** semua **trackBar** dan tambahkan program berikut:

```
//TrackBar Hmin
  private void trackBarHmin_Scroll(object sender, EventArgs e)
 {
     if (trackBarHmax.Value - trackBarHmin.Value <= TRACK_SPACE)
         trackBarHmin.Value = trackBarHmax.Value - TRACK_SPACE;

     Hmin = trackBarHmin.Value;
     labelHmin.Text = string.Format("HMin : {0}", Hmin);
 }

 //TrackBar Hmax
 private void trackBarHmax_Scroll(object sender, EventArgs e)
 {
     if (trackBarHmax.Value - trackBarHmin.Value <= TRACK_SPACE)
         trackBarHmax.Value = trackBarHmin.Value + TRACK_SPACE;

     Hmax = trackBarHmax.Value;
     labelHmax.Text = string.Format("HMax : {0}", Hmax);
 }

//TrackBar Smin
 private void trackBarSmin_Scroll(object sender, EventArgs e)
 {
     if (trackBarSmax.Value - trackBarSmin.Value <= TRACK_SPACE)
         trackBarSmin.Value = trackBarSmax.Value - TRACK_SPACE;

     Smin = (float)trackBarSmin.Value/100;
     labelSmin.Text = string.Format("SMin : {0}", Smin);
 }

//TrackBar Smax
 private void trackBarSmax_Scroll(object sender, EventArgs e)
 {
     if (trackBarSmax.Value - trackBarSmin.Value <= TRACK_SPACE)
         trackBarSmax.Value = trackBarSmin.Value + TRACK_SPACE;

     Smax = (float)trackBarSmax.Value/100;
     labelSmax.Text = string.Format("SMax : {0}", Smax);
 }

 //TrackBar Lmin
 private void trackBarLmin_Scroll(object sender, EventArgs e)
 {
     if (trackBarLmax.Value - trackBarLmin.Value <= TRACK_SPACE)
         trackBarLmin.Value = trackBarLmax.Value - TRACK_SPACE;

     Lmin = (float)trackBarLmin.Value / 100;
     labelLmin.Text = string.Format("LMin : {0}", Lmin);
 }
```

```
//TrackBar Lmax
private void trackBarLmax_Scroll(object sender, EventArgs e)
{
    if (trackBarLmax.Value - trackBarLmin.Value <= TRACK_SPACE)
        trackBarLmax.Value = trackBarLmin.Value + TRACK_SPACE;

    Lmax = (float)trackBarLmax.Value / 100;
    labelLmax.Text = string.Format("LMax : {0}", Lmax);
}
```

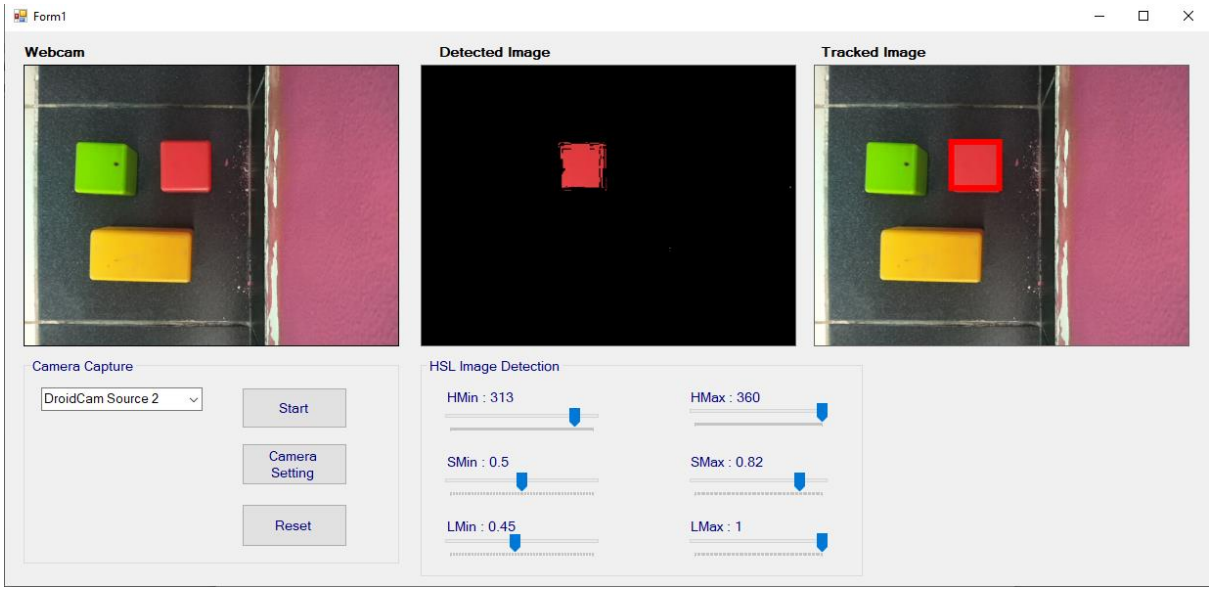
16. **Double klik** button **camera setting** dan tambakan :

```
private void button2_Click(object sender, EventArgs e)
{
    if ((videoDevice != null))
    {
        try
        {

((VideoCaptureDevice)videoDevice).DisplayPropertyPage(this.Handle);
        }
        catch (NotSupportedException ex)
        {
            MessageBox.Show(ex.Message, "Error", MessageBoxButtons.OK,
MessageBoxIcon.Error);
        }
    }
}
```

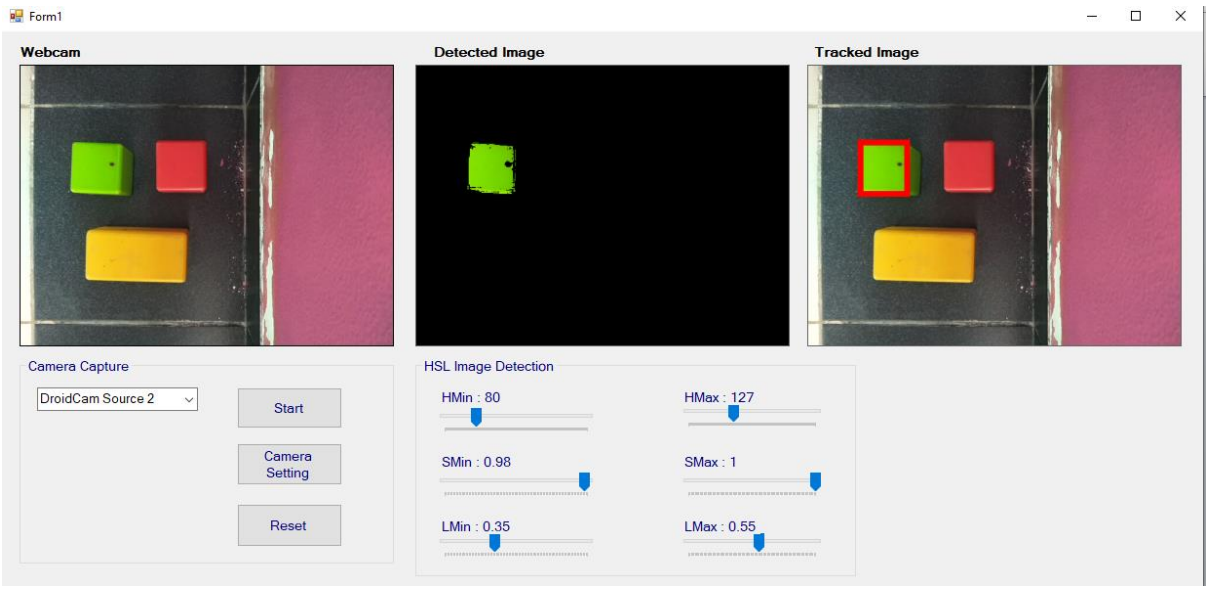
17. **Double klik** button **Reset** dan tambahkan :

```
private void button3_Click(object sender, EventArgs e)
{
    trackBarReset();
    labelReset();
}
```

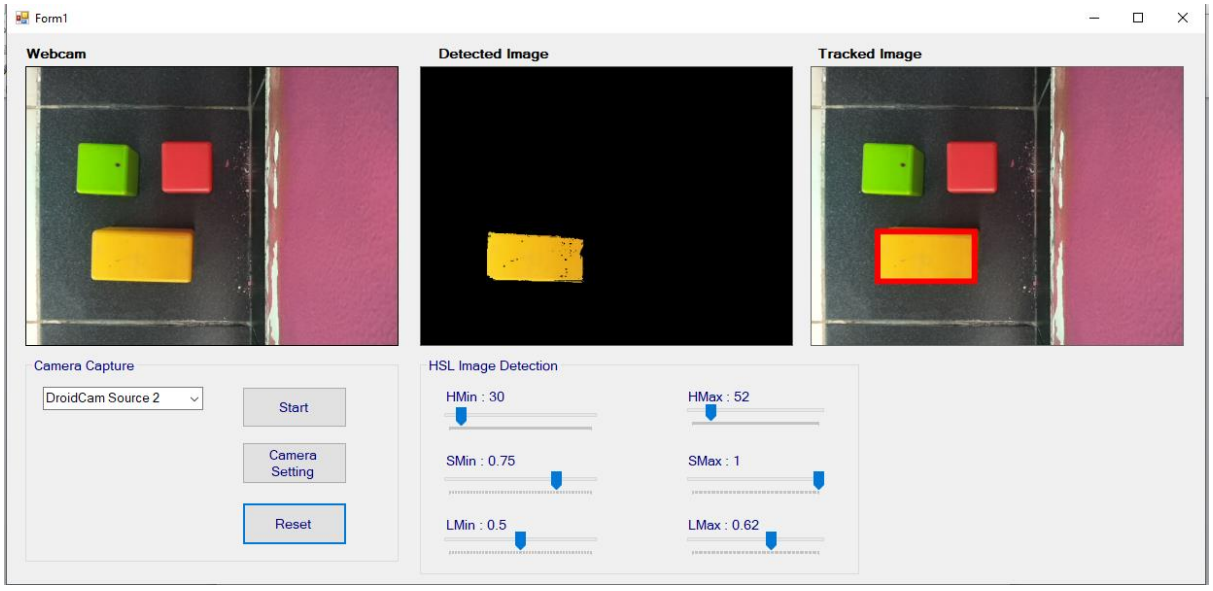
18. Jalankan program dan klik tombol **Start** dan geser **trackbar** sehingga hanya terdeteksi objek yang diinginkan



Objek berwarna merah (313<H<360, 0.5 <S<0.82, 0.45<L<1)



Objek berwarna hijau (80<H<127, 0.98 <S<1, 0.35<L<0.55)



Objek berwarna kuning (30<H<52, 0.75 <S<1, 0. 5<L<0.62)

19. Coba ganti dengan objek yang lain