BAB IV
IMPLEMENTASI

Dalam bab ini berisi implementasi sistem yang merupakan penerapan dari perancangan sistem yang sudah dibahas pada bab sebelumnya.

4.1 PERANGKAT SISTEM

Perangkat sistem terdiri dari perangkat lunak dan perangkat keras yang digunakan dalam penelitian identifikasi pecahan nominal uang kertas rupiah.

4.1.1 Perangkat Lunak

Perangkat lunak yang digunakan dalam penelitian ini adalah :

1. Sistem operasi yang digunakan Windows 8
2. Bahasa pemrograman yang digunakan adalah c#
3. Basis data yang digunakan yaitu MySql Server versi 5.5.16 dengan menggunakan tool XAMPP versi 1.7.7
4. Microsoft Excel 2013, Microsoft Word 2013, Microsoft Visio 2010, Microsoft Visual Studio 2012

4.1.2 Perangkat Keras

Perangkat keras yang digunakan dalam penelitian ini adalah :

1. Prosesor Intel(R) Core(TM) i5-450M CPU @ 2.40 GHz (4 CPUs)
2. Memory (RAM) 4096 MB
3. Hardisk 500 GB
4. Keyboard
5. Mouse
6. Scanner

4.2 IMPLEMENTASI PROGRAM

Aplikasi deteksi pecahan nominal uang kertas rupiah ini terdiri dari beberapa proses dimulai dari open image, preprocesing, input data RGB pada database, perhitungan normalisasi, perhitungan validitas data *training*, perhitungan jarak *euclidean*, perhitungan *weight voting* dan proses penentuan hasil identifikasi.

4.2.1 Proses Open Image

Proses open image digunakan untuk membuka gambar uang agar ditampilkan pada aplikasi sebelum di preprocesing. Tahapan proses open image ditunjukkan pada *source code* 4.1.

Proses Open Image

```
private void button1_Click(object sender, EventArgs e)
        {
            DialogResult hasil = openFileDialog1.ShowDialog();

            if (hasil == DialogResult.OK)
            {
                pictureBox1.ImageLocation = openFileDialog1.FileName;
            }
            MessageBox.Show("Gambar Berhasil Dibuka", "Info",
MessageBoxButtons.OK, MessageBoxIcon.Information);
        }
```

Source *Code* 4. 1 Proses Open Image

4.2.2 Proses Preprocesing Image

Proses preprocesing image ini digunakan untuk memproses image uang yang sudah dibuka untuk mendapatkan data dari image tersebut. Data berupa hasil nilai rata-rata warna, yaitu red, green, dan blue. Data ini yang akan digunakan sebagai input untuk aplikasi ini. Tahapan proses preprocesing image ini adalah dimulai dari crop image, setelah itu ekstraksi rata-rata warna RGB. Proses crop image ditunjukkan pada *source code* berikut.

Proses Crop Image – Tanpa Crop

```
int xPosition = 0;
            int yPosition = 0;
            Bitmap temp = new Bitmap(pictureBox1.Image);
            Bitmap bmap = (Bitmap)temp.Clone();
            int width = bmap.Width * 100 / 100;
            int height = bmap.Height * 100 / 100;
            Rectangle rect = new Rectangle(xPosition, yPosition, width,
```

```
height);
            pictureBox2.Image          =          (Bitmap)bmap.Clone(rect,
bmap.PixelFormat);
```

***Source Code* 4. 2** Proses Crop Image

Proses Crop Image – Crop 75%

```
int xPosition = 0;
            int yPosition = 0;
            Bitmap temp = new Bitmap(pictureBox1.Image);
            Bitmap bmap = (Bitmap)temp.Clone();
            int width = bmap.Width * 75 / 100;
            int height = bmap.Height * 75 / 100;
            Rectangle rect = new Rectangle(xPosition, yPosition, width,
height);
            pictureBox2.Image          =          (Bitmap)bmap.Clone(rect,
bmap.PixelFormat);
```

***Source Code* 4. 3** Proses Crop Image

Proses Crop Image – Crop 50%

```
int xPosition = 0;
            int yPosition = 0;
            Bitmap temp = new Bitmap(pictureBox1.Image);
            Bitmap bmap = (Bitmap)temp.Clone();
            int width = bmap.Width * 50 / 100;
            int height = bmap.Height * 50 / 100;
            Rectangle rect = new Rectangle(xPosition, yPosition, width,
height);
            pictureBox2.Image          =          (Bitmap)bmap.Clone(rect,
bmap.PixelFormat);
```

***Source Code* 4. 4** Proses Crop Image

Proses Crop Image – Crop 25%

```
int xPosition = 0;
            int yPosition = 0;
            Bitmap temp = new Bitmap(pictureBox1.Image);
            Bitmap bmap = (Bitmap)temp.Clone();
            int width = bmap.Width * 25 / 100;
            int height = bmap.Height * 25 / 100;
            Rectangle rect = new Rectangle(xPosition, yPosition, width,
height);
            pictureBox2.Image          =          (Bitmap)bmap.Clone(rect,
bmap.PixelFormat);
```

***Source Code* 4. 5** Proses Crop Image

Dalam hal ini akan ada 4 pilihan yaitu dengan tanpa crop atau crop 75%, crop 50%, dan crop 25%. Karena dalam pengujian nanti akan dibandingkan hasilnya yang menggunakan data tanpa crop dan dengan crop mana yang lebih

baik. Jadi dalam aplikasi akan ada 4 opsi untuk mendapatkan data dari image. Setelah image di crop atau tanpa crop maka akan dilanjutkan dengan proses mendapatkan nilai RGB. Proses get RGB ini ditunjukkan pada *source code* 4.6.

Proses Open Image

```
private void button3_Click(object sender, EventArgs e)
        {
            int totalmerah = 0;
            int totalhijau = 0;
            int totalbiru = 0;
            int jumlahpiksel = 0;
            int avgmerah = 0;
            int avghijau = 0;
            int avgbiru = 0;
            Bitmap bmp = new Bitmap(pictureBox2.Image);
            //Bitmap hasil = (Bitmap)bmp.Clone();
            for (int i = 0; i < bmp.Width; i++)
            {
                for (int j = 0; j < bmp.Height; j++)
                {
                    int merah = bmp.GetPixel(i, j).R;
                    int hijau = bmp.GetPixel(i, j).G;
                    int biru = bmp.GetPixel(i, j).B;
                    totalmerah = totalmerah + merah;
                    totalbiru = totalbiru + biru;
                    totalhijau = totalhijau + hijau;
                    jumlahpiksel = (i + 1) * (j + 1);
                }

            }
            avgmerah = totalmerah / jumlahpiksel;
            avghijau = totalhijau / jumlahpiksel;
            avgbiru = totalbiru / jumlahpiksel;
            textBox1.Text = " " + avgmerah;
            textBox2.Text = " " + avghijau;
            textBox3.Text = " " + avgbiru;
        }
```

***Source Code* 4. 6** Proses Get Rgb Image

Proses get RGB pertama tama adalah menghitung pixel jumlah red, green, dan blue pada setiap pixel. Lalu untuk mendapatkan nilai rata-ratanya setiap jumlah pixel red, green, dan blue dibagi dengan jumlah pixel.

4.2.3 Proses Normalisasi Data

Proses normalisasi data digunakan untuk menormalisasikan data dengan normalisasi min-max. Data yang dinormalisasi adalah atribut data red, green, dan blue. Proses normalisai data dilakukan pada data training dan data testing. Tahapan proses normalisasi data training ditunjukkan pada *source code* 4.7.

Proses Normalisasi Data Training

```
private void datatrainingnormalisasi_Click(object sender, EventArgs e)
        {
            try
            {
                cn.Open();
                string refreshnormalisasi = "Delete from normalisasi;";
                MySqlCommand del = new MySqlCommand(refreshnormalisasi,
cn);
                del.ExecuteNonQuery();
                cn.Close();

                cn.Open();
                string rnormalisasi = "INSERT INTO normalisasi select id,
(red/255), (green/255), (blue/255), jenis from dataset;";
                MySqlCommand normalisasi = new MySqlCommand(rnormalisasi,
cn);
                normalisasi.ExecuteNonQuery();
                cn.Close();

                cn.Open();
                DataTable dt = new DataTable();
                MySqlDataAdapter vnormalisasi = new
MySqlDataAdapter("select * from normalisasi", cn);
                vnormalisasi.Fill(dt);

                datatrainingView1.DataSource = dt;
                cn.Close();

                MessageBox.Show("Data Training Berhasil di Normalisasi",
"Info", MessageBoxButtons.OK, MessageBoxIcon.Information);
            }
            catch (MySqlException a)
            {
                MessageBox.Show(a.ToString(), "Error tampil data");
            }
        }
```

***Source Code* 4. 7** Proses Normalisasi Data Training

Sedangkan normalisasi data testing ditunjukkan pada *source code* 4.8.

Proses Normalisasi Data Testing

```
private void testingnormalisasi_Click(object sender, EventArgs e)
        {
            cn.Open();
            string rtestingnormalisasi = "update testing set
nred=red/255, ngreen=green/255, nblue=blue/255;";
            MySqlCommand testingnormalisasi = new
MySqlCommand(rtestingnormalisasi, cn);
            testingnormalisasi.ExecuteNonQuery();
            cn.Close();
        }
```

***Source Code* 4. 8** Proses Normalisasi Data Training

4.2.4 Proses Perhitungan Validitas Data *Training*

Pada proses perhitungan validitas ini dilakukan dengan membandingkan kelas hasil pecahan nominal pada data *training* sesuai dengan nilai k yang diinputkan. Jika kelas pecahan nominal sama akan bernilai 1 dan jika kelas jenis uang tidak sama maka akan bernilai 0. Kemudian jumlah dari hasil perbandingan tersebut dibagi dengan nilai k yang diiputkan dan menghasilkan nilai validitas setiap data *training*. Tahapan proses perhitungan validitas ditunjukkan pada *source code* 4.9.

Proses Perhitungan Validitas

```
private void validasi_Click(object sender, EventArgs e)
        {
            cn.Open();
            string refreshvalidasi = "Delete from validasi;";
            MySqlCommand delvalidasi = new MySqlCommand(refreshvalidasi,
cn);
            delvalidasi.ExecuteNonQuery();
            cn.Close();

            DataTable dt = new DataTable();
            MySqlDataAdapter adp = new MySqlDataAdapter("SELECT count(id)
as a from normalisasi;", cn);
            adp.Fill(dt);
            datatrainingView1.DataSource = dt;
            cn.Close();
            string jumlahid =
datatrainingView1.CurrentRow.Cells["a"].Value.ToString();
            int jumlahidd = int.Parse(jumlahid);

            int jumlahk = Int32.Parse(textBox4.Text); ;

            for (int ab = 1; ab <= jumlahidd; ab++)
            {
                    if (jumlahk == 1){
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1)
SELECT id, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=2)) ,1,0) k1 FROM dataset where id=('" +
ab + "'); UPDATE validasi SET sum=k1 WHERE id=('" + ab + "'); UPDATE
validasi SET validasi=1/('" + jumlahk + "')*sum WHERE id=('" + ab +
"');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 2)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2) SELECT id, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
```

```
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=2)) ,1,0) k1, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=3))
,1,0) k2 FROM dataset where id=('" + ab + "'); UPDATE validasi SET
sum=k1+k2 WHERE id=('" + ab + "'); UPDATE validasi SET validasi=1/('" +
jumlahk + "')*sum WHERE id=('" + ab + "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 3)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3) SELECT id, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "'))
= (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=2)) ,1,0) k1, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=3))
,1,0) k2, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=4)) ,1,0) k3 FROM dataset where id=('" +
ab + "'); UPDATE validasi SET sum=k1+k2+k3 WHERE id=('" + ab + "');
UPDATE validasi SET validasi=1/3*sum WHERE id=('" + ab + "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 4)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3, k4) SELECT id, IF((SELECT jenis FROM dataset WHERE id=('" + ab +
"')) = (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank
WHERE idasal=('" + ab + "') and rank=2)) ,1,0) k1, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=3))
,1,0) k2, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=4)) ,1,0) k3, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=5))
,1,0) k4 FROM dataset where id=('" + ab + "'); UPDATE validasi SET
sum=k1+k2+k3+k4 WHERE id=('" + ab + "'); UPDATE validasi SET
validasi=1/('" + jumlahk + "')*sum WHERE id=('" + ab + "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 5)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3, k4, k5) SELECT id, IF((SELECT jenis FROM dataset WHERE id=('" +
ab + "')) = (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM
```

```
rank WHERE idasal=('" + ab + "') and rank=2)) ,1,0) k1, IF((SELECT jenis
FROM dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=3))
,1,0) k2,  IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=4)) ,1,0) k3, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=5))
,1,0) k4, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=6)) ,1,0) k5 FROM dataset where id=('" +
ab + "'); UPDATE validasi SET sum=k1+k2+k3+k4+k5 WHERE id=('" + ab + "');
UPDATE validasi SET validasi=1/('" + jumlahk + "')*sum WHERE id=('" + ab
+ "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 6)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3, k4, k5, k6) SELECT id, IF((SELECT jenis FROM dataset WHERE id=('"
+ ab + "')) = (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM
rank WHERE idasal=('" + ab + "') and rank=2)) ,1,0) k1, IF((SELECT jenis
FROM dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=3))
,1,0) k2,  IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=4)) ,1,0) k3, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=5))
,1,0) k4, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=6)) ,1,0) k5, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=7))
,1,0) k6 FROM dataset where id=('" + ab + "'); UPDATE validasi SET
sum=k1+k2+k3+k4+k5+k6 WHERE id=('" + ab + "'); UPDATE validasi SET
validasi=1/('" + jumlahk + "')*sum WHERE id=('" + ab + "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 7)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3, k4, k5, k6, k7) SELECT id, IF((SELECT jenis FROM dataset WHERE
id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan
FROM rank WHERE idasal=('" + ab + "') and rank=2)) ,1,0) k1, IF((SELECT
jenis FROM dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset
WHERE id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and
rank=3)) ,1,0) k2,  IF((SELECT jenis FROM dataset WHERE id=('" + ab +
"')) = (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank
WHERE idasal=('" + ab + "') and rank=4)) ,1,0) k3, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
```

```
id=(SELECT idtujuan FROM rank WHERE idasal='" + ab + "') and rank=5))
,1,0) k4, IF((SELECT jenis FROM dataset WHERE id='" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal='" + ab + "') and rank=6)) ,1,0) k5, IF((SELECT jenis FROM
dataset WHERE id='" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal='" + ab + "') and rank=7))
,1,0) k6, IF((SELECT jenis FROM dataset WHERE id='" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal='" + ab + "') and rank=8)) ,1,0) k7 FROM dataset where id='" +
ab + "'); UPDATE validasi SET sum=k1+k2+k3+k4+k5+k6+k7 WHERE id='" + ab
+ "'); UPDATE validasi SET validasi=1/('" + jumlahk + "')*sum WHERE
id='" + ab + "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 8)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3, k4, k5, k6, k7, k8) SELECT id, IF((SELECT jenis FROM dataset
WHERE id='" + ab + "')) = (SELECT jenis FROM dataset WHERE id=(SELECT
idtujuan FROM rank WHERE idasal='" + ab + "') and rank=2)) ,1,0) k1,
IF((SELECT jenis FROM dataset WHERE id='" + ab + "')) = (SELECT jenis
FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE idasal='" + ab +
"') and rank=3)) ,1,0) k2,  IF((SELECT jenis FROM dataset WHERE id='" +
ab + "')) = (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM
rank WHERE idasal='" + ab + "') and rank=4)) ,1,0) k3, IF((SELECT jenis
FROM dataset WHERE id='" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal='" + ab + "') and rank=5))
,1,0) k4, IF((SELECT jenis FROM dataset WHERE id='" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal='" + ab + "') and rank=6)) ,1,0) k5, IF((SELECT jenis FROM
dataset WHERE id='" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal='" + ab + "') and rank=7))
,1,0) k6, IF((SELECT jenis FROM dataset WHERE id='" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal='" + ab + "') and rank=8)) ,1,0) k7, IF((SELECT jenis FROM
dataset WHERE id='" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal='" + ab + "') and rank=9))
,1,0) k8 FROM dataset where id='" + ab + "'); UPDATE validasi SET
sum=k1+k2+k3+k4+k5+k6+k7+k8 WHERE id='" + ab + "'); UPDATE validasi SET
validasi=1/('" + jumlahk + "')*sum WHERE id='" + ab + "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 9)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3, k4, k5, k6, k7, k8, k9) SELECT id, IF((SELECT jenis FROM dataset
WHERE id='" + ab + "')) = (SELECT jenis FROM dataset WHERE id=(SELECT
idtujuan FROM rank WHERE idasal='" + ab + "') and rank=2)) ,1,0) k1,
IF((SELECT jenis FROM dataset WHERE id='" + ab + "')) = (SELECT jenis
FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE idasal='" + ab +
"') and rank=3)) ,1,0) k2,  IF((SELECT jenis FROM dataset WHERE id='" +
```

```
ab + "')) = (SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM
rank WHERE idasal=('" + ab + "') and rank=4)) ,1,0) k3, IF((SELECT jenis
FROM dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=5))
,1,0) k4, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=6)) ,1,0) k5, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=7))
,1,0) k6, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=8)) ,1,0) k7, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=9))
,1,0) k8, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=10)) ,1,0) k9 FROM dataset where id=('" +
ab + "'); UPDATE validasi SET sum=k1+k2+k3+k4+k5+k6+k7+k8+k9 WHERE id=('"
+ ab + "'); UPDATE validasi SET validasi=1/('" + jumlahk + "')*sum WHERE
id=('" + ab + "');";
                        MySqlCommand validasi = new
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }
                    else if (jumlahk == 10)
                    {
                        cn.Open();
                        string rvalidasi = "INSERT INTO validasi(id, k1,
k2, k3, k4, k5, k6, k7, k8, k9, k10) SELECT id, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=2))
,1,0) k1, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=3)) ,1,0) k2,  IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=4))
,1,0) k3, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=5)) ,1,0) k4, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=6))
,1,0) k5, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=7)) ,1,0) k6, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=8))
,1,0) k7, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=9)) ,1,0) k8, IF((SELECT jenis FROM
dataset WHERE id=('" + ab + "')) = (SELECT jenis FROM dataset WHERE
id=(SELECT idtujuan FROM rank WHERE idasal=('" + ab + "') and rank=10))
,1,0) k9, IF((SELECT jenis FROM dataset WHERE id=('" + ab + "')) =
(SELECT jenis FROM dataset WHERE id=(SELECT idtujuan FROM rank WHERE
idasal=('" + ab + "') and rank=11)) ,1,0) k10 FROM dataset where id=('" +
ab + "'); UPDATE validasi SET sum=k1+k2+k3+k4+k5+k6+k7+k8+k9+k10 WHERE
id=('" + ab + "'); UPDATE validasi SET validasi=1/('" + jumlahk + "')*sum
WHERE id=('" + ab + "');";
                        MySqlCommand validasi = new
```

```
MySqlCommand(rvalidasi, cn);
                        validasi.ExecuteNonQuery();
                        cn.Close();
                    }

            }

            cn.Open();
            DataTable eu = new DataTable();
            MySqlDataAdapter vvalidasi= new MySqlDataAdapter("select *
from validasi", cn);
            vvalidasi.Fill(eu);

            datatrainingView1.DataSource = eu;
            cn.Close();

            MessageBox.Show("Proses Validasi Berhasil", "Info",
MessageBoxButtons.OK, MessageBoxIcon.Information);
        }
```

***Source Code* 4. 9** Proses Perhitungan Validitas

4.2.5 Proses Perhitungan Jarak *Euclidean*

Proses perhitungan jarak *euclidean* digunakan untuk mencari nilai jarak *interval scaled* variabel. Tahapan proses perhitungan jarak *euclidean* ditunjukkan pada *source code* 4.10.

Proses Perhitungan Jarak *Euclidean*

```
private void euclidean_Click(object sender, EventArgs e)
        {
            //int ab, ba;
            DataTable dt = new DataTable();
            MySqlDataAdapter adp = new MySqlDataAdapter("SELECT count(id)
as a from normalisasi;", cn);
            adp.Fill(dt);
            datatrainingView1.DataSource = dt;
            cn.Close();
            string jumlahid =
datatrainingView1.CurrentRow.Cells["a"].Value.ToString();
            int jumlahidd = int.Parse(jumlahid);

            cn.Open();
            string refresheuclidean = "Delete from euclidean;";
            MySqlCommand del = new MySqlCommand(refresheuclidean, cn);
            del.ExecuteNonQuery();
            cn.Close();

            cn.Open();
            string refreshrank = "Delete from rank;";
            MySqlCommand delrank = new MySqlCommand(refreshrank, cn);
            delrank.ExecuteNonQuery();
            cn.Close();

            for (int ab = 1; ab <= jumlahidd; ab++){
```

```
                for (int ba = 1; ba <= jumlahidd; ba++)
                {
                    cn.Open();
                    string reuclidean = "insert into euclidean select
(select id from normalisasi where id=('"+ ab +"')), (select id from
normalisasi where id=('"+ ba +"')), (SELECT distinct sqrt( power((select
red from normalisasi where id=('"+ ab +"'))-(select red from normalisasi
where id=('"+ ba +"')),2) +  power((select green from normalisasi where
id=('"+ ab +"'))-(select green from normalisasi where id=('"+ ba +"')),2)
+  power((select blue from normalisasi where id=('"+ ab +"'))-(select
blue from normalisasi where id=('"+ ba +"')),2)) FROM `normalisasi`);";
                    MySqlCommand euclidean = new MySqlCommand(reuclidean,
cn);
                    euclidean.ExecuteNonQuery();
                    cn.Close();
                }
                cn.Open();
                string rrank = "INSERT INTO rank SELECT idasal, idtujuan,
@curRank := @curRank + 1 AS rank FROM euclidean, (SELECT @curRank := 0) r
where idasal='" + ab + "') ORDER BY jarak;";
                MySqlCommand rank = new MySqlCommand(rrank, cn);
                rank.ExecuteNonQuery();
                cn.Close();
            }

            cn.Open();
            DataTable eu = new DataTable();
            MySqlDataAdapter veuclidean = new MySqlDataAdapter("select *
from euclidean", cn);
            veuclidean.Fill(eu);

            datatrainingView1.DataSource = eu;
            cn.Close();

            MessageBox.Show("Perhitungan Jarak Antar Data Training
Berhasil", "Info", MessageBoxButtons.OK, MessageBoxIcon.Information);
        }
```

***Source Code* 4. 10** Perhitungan Jarak *Euclidean*

4.2.6 Proses Perhitungan *Weight Voting*

Pada proses hitung *weight voting* ini membahas perhitungan bobot pada data rata-rata warna RGB, yaitu dengan membandingkan data validitas dengan *euclidean*. Dari tahapan ini akan dilakukan pembobotan, yang bertujuan untuk menentukan kelas pada data *testing*. Proses perhitungan *weight voting* ditunjukkan pada *source code* 4.11.

Proses Perhitungan Weight Voting

```
private void testingweight_Click(object sender, EventArgs e)
        {
            DataTable dt = new DataTable();
            MySqlDataAdapter adp = new MySqlDataAdapter("SELECT count(id)
```

```
as a from normalisasi;", cn);
            adp.Fill(dt);
            datatrainingView1.DataSource = dt;
            cn.Close();
            string jumlahid =
datatrainingView1.CurrentRow.Cells["a"].Value.ToString();
            int jumlahidd = int.Parse(jumlahid);

            cn.Open();
            string refreshweight = "Delete from testingweight;";
            MySqlCommand delweight = new MySqlCommand(refreshweight, cn);
            delweight.ExecuteNonQuery();
            cn.Close();


            for (int ab = 1; ab <= jumlahidd; ab++)
            {
                cn.Open();
                string rtweight = "insert into testingweight(id, weight)
select id, validasi*(1/(jarak+0.5)) from validasi, testingeuclidean where
id=('"+ab+"') and idtujuan=('"+ab+"') ;";
                MySqlCommand tweight = new MySqlCommand(rtweight, cn);
                tweight.ExecuteNonQuery();
                cn.Close();
            }

            cn.Open();
            string rrank = "UPDATE testingweight set rank = FIND_IN_SET(
weight, ( SELECT GROUP_CONCAT( weight ORDER BY weight DESC ) FROM (select
weight from testingweight) as a));";
            MySqlCommand rank = new MySqlCommand(rrank, cn);
            rank.ExecuteNonQuery();
            cn.Close();

            cn.Open();
            DataTable eu = new DataTable();
            MySqlDataAdapter vtweight = new MySqlDataAdapter("select *
from testingweight", cn);
            vtweight.Fill(eu);

            datatrainingView1.DataSource = eu;
            cn.Close();
        }
```

***Source Code* 4. 11** Perhitungan *Weight Voting*

4.2.7 Proses Perhitungan Hasil Klasifikasi

Pada proses perhitungan hasil klasifikasi ini membahas perhitungan hasil klasifikasi berdasarkan k yang sudah ditentukan di awal. Proses ini adalah dari hasil urutan pembobotan lalu di ambil berdasarkan k yang sudah di tentukan. Nilai yang terbanyak akan menjadi hasil akhir dari proses identifikasi nominal uang . Proses perhitungan hasil klasifikasi ditunjukkan pada *source code* 4.12.

Proses Perhitungan Hasil Klasifikasi

```
private void hasiltesting_Click(object sender, EventArgs e)
        {
            cn.Open();
            string rk = "Delete from k;";
            MySqlCommand delk = new MySqlCommand(rk, cn);
            delk.ExecuteNonQuery();
            cn.Close();

            int jumlahidd = Int32.Parse(textBox4.Text); ;

            for (int ab = 1; ab <= jumlahidd; ab++)
            {
                cn.Open();
                string rtk = "INSERT INTO k SELECT testingweight.rank,
dataset.jenis  from dataset INNER JOIN testingweight ON dataset.id =
testingweight.id WHERE rank = ('" +ab+ "') ;";
                MySqlCommand tk = new MySqlCommand(rtk, cn);
                tk.ExecuteNonQuery();
                cn.Close();
            }

            cn.Open();
            DataTable eu = new DataTable();
            MySqlDataAdapter vtk = new MySqlDataAdapter("SELECT
jenis,count(jenis) AS totalk FROM k GROUP BY (jenis) ORDER BY (totalk)
DESC LIMIT 1", cn);
            vtk.Fill(eu);

            datatrainingView1.DataSource = eu;
            cn.Close();
        }
```

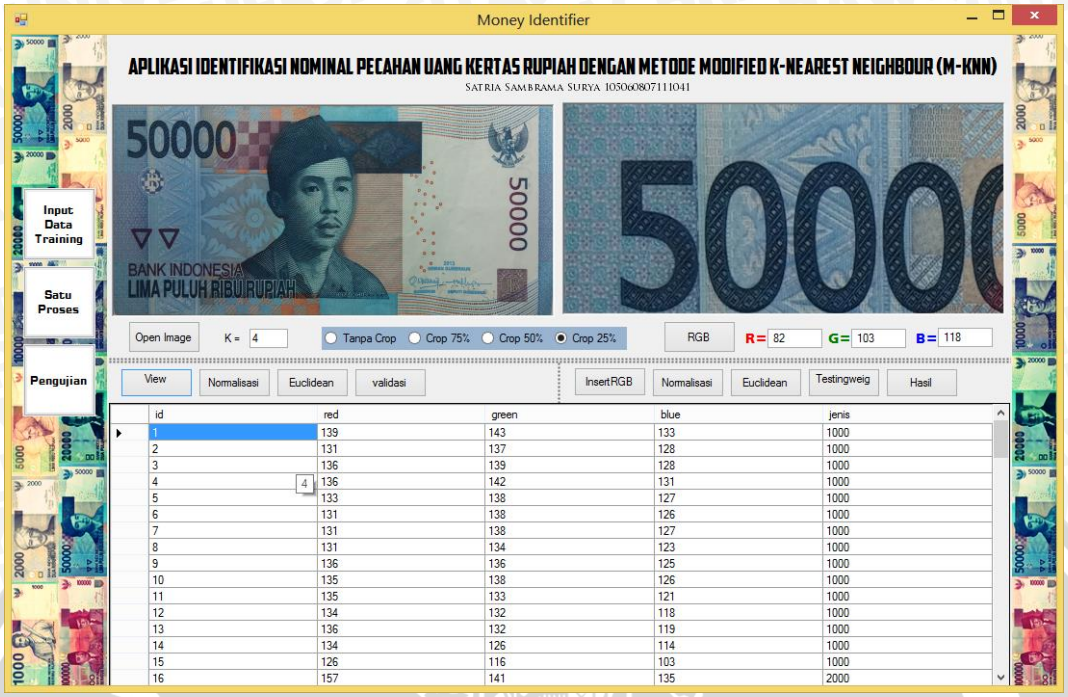
***Source Code* 4. 12** Perhitungan Hasil Klasifikasi

4.3 IMPLEMENTASI ANTARMUKA

Antarmuka aplikasi identifikasi nominal pecahan uang kertas rupiah digunakan pengguna untuk berinteraksi dengan sistem.

4.3.1 Tampilan Form Home

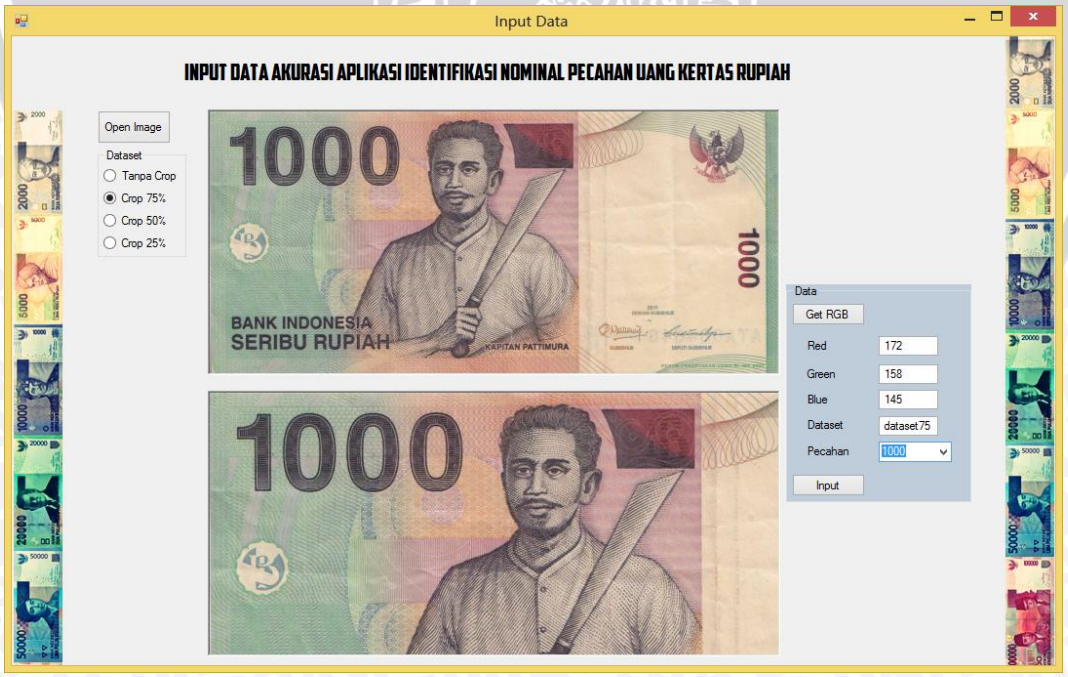
Pada form ini pengguna akan dapat mengakses beberapa menu dan dapat memasukkan image untuk dilakukan proses perhitungan menggunakan metode MKNN untuk identifikasi uang kertas. Gambar form tampilan depan aplikasi ini ditunjukkan pada gambar 4.1.



Gambar 4. 1 Tampilan Form Home

4.3.2 Tampilan Form Input Data Training

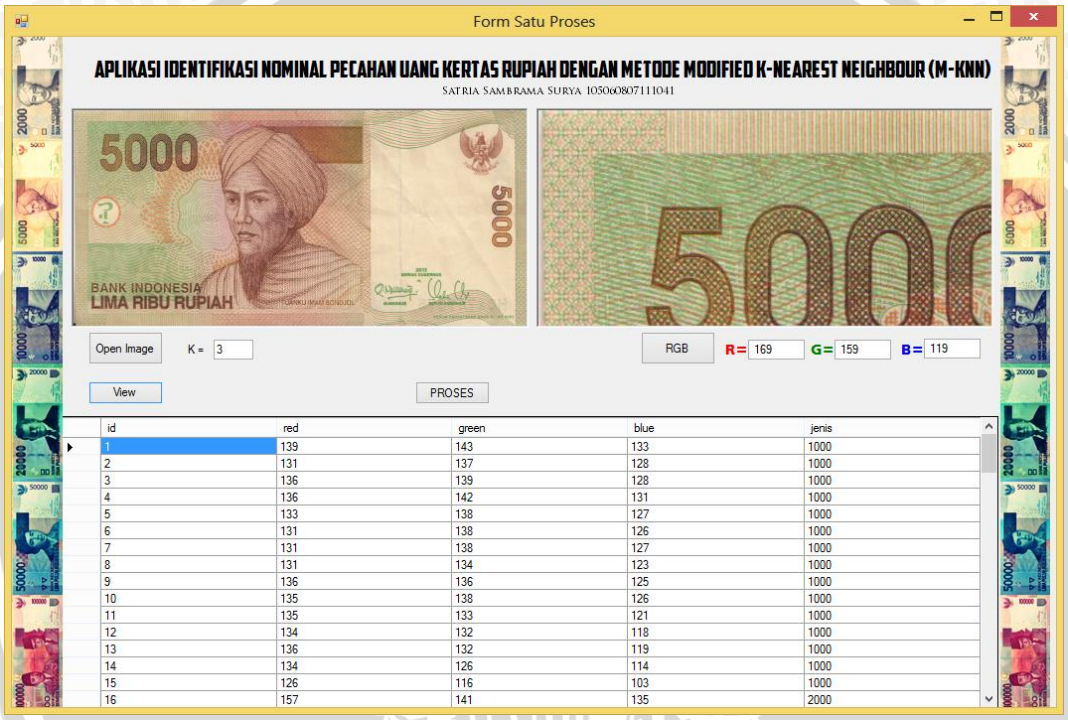
Pada Form ini akan digunakan untuk memasukkan data dari ekstraksi RGB gambar uang pada database data training. Gambar form Input Data Training ditunjukkan pada gambar 4.2.



Gambar 4. 2 Tampilan Form Input Data Training

4.3.3 Tampilan Satu Proses

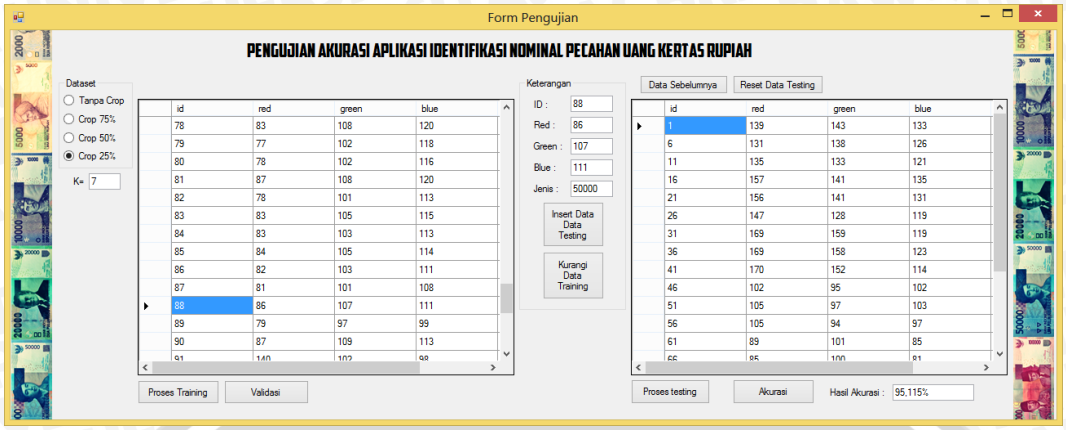
Pada form ini dasarnya sama dengan pada form tampilan depan, yang membuat beda hanya pada tombil. Pada form ini digunakan hanya 1 tombol yaitu 1 tombol proses, berbeda pada form tampilan depan yang menggunakan tombol langkah per langkah. Form ini digunakan untuk lebih mempermudah user untuk melakukan proses identifikasi uang kertas menggunakan metode MKNN. Gambar form tampilan depan aplikasi ini ditunjukkan pada gambar 4.3.



Gambar 4. 3 Tampilan Form Satu Prose

4.3.4 Tampilan Form Pengujian

Pada form ini pengguna akan dapat mengakses beberapa menu dan dapat memasukkan image untuk dilakukan proses perhitungan menggunakan metode MKNN untuk menentukan identifikasi uang yang sesuai. Gambar form tampilan depan aplikasi ini ditunjukkan pada gambar 4.4.



Gambar 4. 4 Tampilan Form Pengujian