# **BAB III ANALISIS DAN PERANCANGAN**

**3.1 Analisis**

**3.1.1 Analisis Proses**

**3.1.1.1 Konversi Citra Grayscale**

Dalam *image processing* banyak dilakukan konversi citra berwarna menjadi grayscale. Tujuan dari konversi citra ini adalah untuk memperkecil memori yang dibutuhkan sehingga dapat mempercepat proses yang dilakukan. Proses ini sangat membantu dalam pemrograman karena dapat memanipulasi bit yang tidak terlalu banyak. Citra berwarna terdiri dari 3 layer matrik yaitu R-layer, G-layer, dan B-layer. Untuk mengubah citra berwarna yang mempunyai nilai matrik masing-masing r, g, dan b menjadi gray scale dengan nilai s, maka konversi dapat dilakukan dengan mengambil rata-rata dari nilai r, g, dan b sehingga dapat dituliskan menjadi :

dimana :

I (i,,j) = Nilai intensitas citra grayscale

R (i,j) = nilai intensitas warna merah dari citra asal

G (i,j) = nilai intensitas warna hijau dari citra asal

B (i,j) = nilai intensitas warna biru dari citra asal

Flowchart :>>>>>>

Berikut contoh dari proses konversi citra RGB menjadi citra *grayscale.* Asumsikan citra adalah 8x8 *pixel* dengan nilai RGB nya sebagai berikut :



*Matrix* citra asli

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| R = 181 | R = 181 | R = 165 | R = 165 | R = 156 | R = 156 | R = 156 | R = 156 |
| G = 57 | G = 74 | G = 57 | G = 57 | G = 49 | G = 49 | G = 49 | G = 49 |
| B = 115 | B = 115 | B = 107 | B = 107 | B = 99 | B = 99 | B = 99 | B = 99 |
| R = 181 | R = 173 | R = 165 | R = 165 | R = 165 | R = 156 | R = 156 | R = 156 |
| G = 57 | G = 66 | G = 57 | G = 57 | G = 57 | G = 49 | G = 49 | G = 49 |
| B = 115 | B = 107 | B = 107 | B = 107 | B = 107 | B = 99 | B = 99 | B = 99 |
| R = 173 | R = 165 | R = 156 | R = 165 | R = 148 | R = 140 | R = 140 | R = 140 |
| G = 66 | G = 57 | G = 49 | G = 57 | G = 41 | G = 33 | G = 33 | G = 33 |
| B = 107 | B = 99 | B = 90 | B = 99 | B = 90 | B = 82 | B = 82 | B = 82 |
| R = 206 | R = 189 | R = 165 | R = 165 | R = 148 | R = 148 | R = 132 | R = 132 |
| G = 99 | G = 82 | G = 57 | G = 57 | G = 41 | G = 41 | G = 24 | G = 24 |
| B = 140 | B = 123 | B = 99 | B = 99 | B = 90 | B = 90 | B = 74 | B = 74 |
| R = 239 | R = 231 | R = 206 | R = 198 | R = 189 | R = 173 | R = 132 | R = 140 |
| G = 132 | G = 123 | G = 99 | G = 90 | G = 82 | G = 66 | G = 49 | G = 33 |
| B = 173 | B = 165 | B = 140 | B = 132 | B = 123 | B = 107 | B = 82 | B = 74 |
| R = 247 | R = 239 | R = 231 | R = 231 | R = 222 | R = 206 | R = 173 | R = 173 |
| G = 140 | G = 132 | G = 123 | G = 123 | G = 115 | G = 99 | G = 90 | G = 66 |
| B = 181 | B = 173 | B = 165 | B = 165 | B = 156 | B = 140 | B = 123 | B = 107 |
| R = 255 | R = 255 | R = 247 | R = 247 | R = 239 | R = 239 | R = 239 | R = 231 |
| G = 156 | G = 156 | G = 148 | G = 148 | G = 140 | G = 132 | G = 132 | G = 123 |
| B = 173 | B = 173 | B = 165 | B = 165 | B = 156 | B = 173 | B = 173 | B = 165 |
| R = 255 | R = 255 | R = 255 | R = 255 | R = 255 | R = 255 | R = 255 | R = 247 |
| G = 156 | G = 156 | G = 156 | G = 156 | G = 156 | G = 148 | G = 148 | G = 140 |
| B = 173 | B = 173 | B = 173 | B = 173 | B = 173 | B = 189 | B = 189 | B = 181 |

Pada *matrix* citra asli diatas *pixel* ke -1 dengan nilai R = 181, G = 57 dan B = 115. Dengan menggunakan rumus *average* untuk mengubah citra RGB menjadi *grayscale* dan perhitungan dilakukan untuk semua *pixel* dengan hasil konversi *matrix* sebagai berikut :

Citra Grayscale

3.1.1.2 Perbaikan citra

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

Flowchart>>>>>>>>>>>

*Matrix* citra *grayscale* yang akan dilakukan perbaikan

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

Dilakukan penentuan *mask filter*,penentuan *mask filter* misalnya dengan ukuran *matrix* 3 x 3. Karena ukuran *mask filter* 3 x 3 maka *matrix* diatas harus diurutkan terlebih dahulu dan dimasukkan kedalam *matrix* berukuran 1 x 9.

*Mask* *filter* 3 x 3 setelah diurutkan ke – 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 98 | 107 | 110 | 110 | 115 | 115 | 118 | 118 | 123 |

Dengan menggunakan rumus *median filtering* pada persamaan (…..) sebagai berikut didapat nilai tengah

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

Dari gambar diatas dapat dicari nilai *pixel* yang baru dengan menggunakan rumus *median filtering*. Maka nilai mediannya adalah . Nilai *pixel*  yang baru akan menggantikan nilai *pixel* pada citra awal sehingga warna pada *pixel* sebelumnya akan berbeda. Karena nilai *median* sama dengan posisi tengah pada *mask filter* maka tidak terjadi perubahan dan proses perhitungan *median filtering* menggunakan citra awal.

*Mask* *filter* 3 x 3 setelah diurutkan ke – 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 98 | 107 | 107 | 110 | 110 | 110 | 110 | 115 | 123 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke - 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 93 | 98 | 101 | 107 | 110 | 110 | 110 | 110 | 110 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke - 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 4

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 85 | 93 | 101 | 101 | 101 | 107 | 110 | 110 | 110 |

, pada posisi ke – 4 didapatkan nilai tengahnya

*Mask median filter* ke - 4

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 85 | 85 | 93 | 101 | 101 | 101 | 101 | 101 | 110 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke - 5

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 6

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 85 | 85 | 85 | 101 | 101 | 101 | 101 | 101 | 101 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 6

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 7

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 98 | 107 | 107 | 110 | 115 | 115 | 118 | 131 | 148 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 8

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 98 | 107 | 107 | 107 | 107 | 110 | 110 | 115 | 131 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 8

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 9

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 93 | 93 | 98 | 107 | 107 | 107 | 110 | 110 | 110 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 9

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 10

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 85 | 93 | 93 | 93 | 101 | 107 | 107 | 110 | 110 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 10

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke -11

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77 | 85 | 85 | 93 | 93 | 93 | 101 | 101 | 110 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 11

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 12

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77 | 77 | 85 | 85 | 85 | 93 | 101 | 101 | 101 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 12

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 13

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 98 | 107 | 107 | 115 | 131 | 148 | 148 | 173 | 181 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 13

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 14

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 98 | 107 | 107 | 107 | 107 | 131 | 140 | 148 | 173 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 14

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 15

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 93 | 93 | 98 | 107 | 107 | 107 | 131 | 140 | 148 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 15

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 16

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 85 | 93 | 93 | 93 | 107 | 107 | 115 | 131 | 140 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 16

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 17

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77 | 85 | 85 | 88 | 93 | 93 | 93 | 115 | 131 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 17

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 18

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77 | 77 | 82 | 85 | 85 | 85 | 88 | 93 | 115 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 18

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 19

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 107 | 131 | 148 | 148 | 173 | 173 | 181 | 181 | 189 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 19

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 20

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 107 | 107 | 131 | 140 | 148 | 173 | 173 | 173 | 181 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 20

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 21

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 93 | 107 | 107 | 131 | 140 | 148 | 164 | 173 | 173 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 21

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 22

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 93 | 93 | 107 | 115 | 131 | 140 | 148 | 164 | 173 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 22

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 23

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77 | 88 | 93 | 93 | 115 | 129 | 131 | 148 | 164 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 23

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 24

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77 | 77 | 82 | 88 | 93 | 115 | 115 | 129 | 148 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 24

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 25

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 148 | 173 | 173 | 181 | 181 | 187 | 189 | 195 | 195 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 25

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 26

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 140 | 148 | 173 | 173 | 173 | 181 | 187 | 187 | 195 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 26

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 27

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 131 | 140 | 148 | 164 | 173 | 173 | 178 | 187 | 187 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 27

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 28

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 115 | 131 | 140 | 148 | 164 | 173 | 178 | 187 | 181 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 28

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 29

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 88 | 115 | 129 | 131 | 148 | 164 | 178 | 181 | 181 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 29

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 30

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 82 | 88 | 115 | 115 | 129 | 148 | 173 | 181 | 181 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 30

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 31

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 173 | 181 | 187 | 189 | 195 | 195 | 195 | 195 | 195 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 31

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 32

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 173 | 173 | 181 | 187 | 187 | 195 | 195 | 195 | 195 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 32

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 33

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 164 | 173 | 173 | 178 | 187 | 187 | 195 | 195 | 195 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 33

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 34

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 148 | 164 | 173 | 178 | 181 | 187 | 195 | 195 | 197 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 34

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 35

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 129 | 148 | 164 | 178 | 181 | 181 | 195 | 197 | 197 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 35

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

*Mask* *filter* 3 x 3 setelah diurutkan ke - 36

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 115 | 129 | 148 | 173 | 181 | 181 | 189 | 197 | 197 |

, pada posisi ke – 5 didapatkan nilai tengahnya

*Mask median filter* ke – 36

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 110 | 101 | 101 | 101 |
| 115 | 107 | 98 | 107 | 93 | 85 | 85 | 85 |
| 148 | 131 | 107 | 107 | 93 | 93 | 77 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 88 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 178 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |

Hasil *Median Filter*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 118 | 123 | 110 | 110 | 101 | 101 | 101 | 101 |
| 118 | 115 | 110 | 110 | 101 | 101 | 101 | 101 |
| 115 | 115 | 107 | 107 | 101 | 93 | 85 | 85 |
| 148 | 131 | 107 | 107 | 107 | 93 | 85 | 77 |
| 181 | 173 | 148 | 140 | 131 | 115 | 93 | 82 |
| 189 | 181 | 173 | 173 | 164 | 148 | 129 | 115 |
| 195 | 195 | 187 | 187 | 181 | 181 | 181 | 173 |
| 195 | 195 | 195 | 195 | 195 | 197 | 197 | 189 |