Tabel 1. Data Training

|  |  |  |  |
| --- | --- | --- | --- |
| **Huruf Hasil Thinning** | **Fitur** | | |
| **Jumlah Titik** | **Posisi Titik** | **Chain code Ter-Normalisasi** |
| C:\Users\ainawind27\AppData\Local\Microsoft\Windows\INetCache\Content.Word\timesnewroman_ba_terpisah_zhangsuen.png | 1 | 2 | 6, 6, 5, 4, 4, 4, 4, 4, 2, 2 |
| C:\Users\ainawind27\AppData\Local\Microsoft\Windows\INetCache\Content.Word\timesnewroman_ba_diawal_zhangsuen.png | 1 | 2 | 6, 6, 6, 6, 6, 6, 8, 8, 8, 8 |
| C:\Users\ainawind27\AppData\Local\Microsoft\Windows\INetCache\Content.Word\timesnewroman_ba_ditengah_zhangsuen.png | 1 | 2 | 6, 6, 6, 6, 6, 6, 8, 8, 8, 8 |
| C:\Users\ainawind27\AppData\Local\Microsoft\Windows\INetCache\Content.Word\timesnewroman_ba_diakhir_zhangsuen.png | 1 | 2 | 6, 5, 4, 4, 4, 4, 2, 2, 6, 4 |

### **IV.1.2 Hasil Pengujian Sistem Pengenalan Huruf Arab dengan Neural Network**

1. Hasil Pengujian Huruf Terisolasi

Pengujian dengan memasukkan 31 huruf Arab dalam 3 font yang berbeda ke dalam sistem. Sistem menghitung persentse masing – masing kemungkinan huruf yang mungkin dikenali, huruf yang memiliki persentase terbesar akan muncul sebagai huruf yang dikenali. Berdasarkan hasil pengenalan dengan neural network, di dapat hasil pengenalan huruf Arab terisolasi dalam tabel IV.2.

Tabel IV.2 Data hasil pengujian pengenalan huruf Arab terisolasi dengan metode neural network

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Huruf** | **Font** | | |
| **Arial Unicode Ms** | **Tahoma** | **Times New Roman** |
| 1 | Ain | **√** | **√** | **√** |
| 2 | alif | **√** | **√** | **√** |
| 3 | Ba | **√** | **√** | **√** |
| 4 | Dal | **√** | **√** | **√** |
| 5 | Dhad | **√** | **√** | **√** |
| 6 | Dzal | **√** | **√** | **√** |
| 7 | Dzo | **√** | **√** | **√** |
| 8 | Fa | **√** | **√** | **√** |
| 9 | Ghoin | **√** | **√** | **√** |
| 10 | Hamzah | **√** | **√** | **√** |
| 11 | Ha | **√** | **√** | **√** |
| 12 | Habesar | **√** | **√** | **√** |
| 13 | Jim | **√** | **√** | **√** |
| 14 | Kaf | **√** | **√** | **√** |
| 15 | Kha | **√** | **√** | **√** |
| 16 | Lam | **√** | **√** | **√** |
| 17 | Mim | **√** | **√** | **√** |
| 18 | Nun | **√** | **√** | **√** |
| 19 | Qaf | **√** | **√** | **√** |
| 20 | Ra | **√** | **√** | **√** |
| 21 | Sad | **√** | **√** | **√** |
| 22 | Sheen | **√** | **√** | **√** |
| 23 | Sin | **√** | **√** | **√** |
| 24 | Tamarbuto | **√** | **√** | **√** |
| 25 | Ta | **√** | **√** | **√** |
| 26 | Tho | **√** | **√** | **√** |
| 27 | Tsa | **√** | **√** | **√** |
| 28 | Waw | **√** | **√** | **√** |
| 29 | Ya | **√** | **√** | **√** |
| 30 | Za | **√** | **√** | **√** |
| 31 | Lamalif | **√** | **√** | **√** |
| Akurasi | | **100%** | **100%** | **100%** |

1. Hasil Pengujian Huruf Arab dalam Kalimat

Dalam pengujian huruf dalam kalimat dilakukan dengan memasukkan 10 kalimat Arab kedalam sistem. Hasil pengujian terhadap pengenalan hurufArab dalam kalimat dengan metode neural network tedapat pada tabel IV.3

Tabel IV.3 Data hasil pengujian pengenalan huruf Arab dalam kalimat dengan metode neural network

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Kalimat** | **Akurasi Font** | | |
| **Arial Unicode Ms** | **Tahoma** | **Times New Roman** |
| 1 | Kalimat 1 | 68.18% | 65.38% | 79.17% |
| 2 | Kalimat 2 | 70.59% | 64.71% | 82.35% |
| 3 | Kalimat 3 | 60.00% | 72.73% | 76.19% |
| 4 | Kalimat 4 | 75.00% | 76.47% | 76.47% |
| 5 | Kalimat 5 | 76.92% | 53.85% | 76.92% |
| 6 | Kalimat 6 | 63.64% | 59.09% | 73.91% |
| 7 | Kalimat 7 | 50.00% | 73.33% | 71.43% |
| 8 | Kalimat 8 | 64.29% | 71.41% | 71.43% |
| 9 | Kalimat 9 | 68.75% | 66.67% | 72.22% |
| 10 | Kalimat 10 | 63.63 | 59.09% | 68.18% |
| Ra5ta-Rata | | 66.10% | 66.27% | 74.83% |

### **IV.1.3 Hasil Pengujian Sistem Pengenalan Huruf Arab dengan Hidden Markov Model**

1. Hasil Pengujian Huruf Terisolasi

Pengujian dengan memasukkan 31 huruf Arab dalam 3 font yang berbeda ke dalam sistem. Kemudian sistem melakukan penghitungan evaluasi dengan menghasilkan nilai peluang. Nilai peluang yang tertinggi menunjukkan tingkat kemiripan data huruf yang diujikan terhadap basis data yang merupakan hasil pelatihan data latih. Berdasarkan hasil pengenalan dengan hidden markov model, di dapat hasil pengenalan huruf Arab terisolasi dalam tabel IV.4.

Tabel IV.4 Data hasil pengujian pengenalan huruf Arab terisolasi dengan metode hiden markov model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Huruf** | **Akurasi Font** | | |
| **Arial Unicode Ms** | **Tahoma** | **Times New Roman** |
| 1 | Ain | **√** | **X** | **√** |
| 2 | alif | **√** | **√** | **√** |
| 3 | Ba | **X** | **√** | **X** |
| 4 | Dal | **√** | **√** | **√** |
| 5 | Dhad | **√** | **X** | **√** |
| 6 | Dzal | **X** | **√** | **√** |
| 7 | Dzo | **√** | **√** | **√** |
| 8 | Fa | **√** | **√** | **√** |
| 9 | Ghoin | **X** | **X** | **√** |
| 10 | Hamzah | **√** | **√** | **√** |
| 11 | Ha | **√** | **X** | **X** |
| 12 | Habesar | **X** | **√** | **X** |
| 13 | Jim | **√** | **X** | **√** |
| 14 | Kaf | **√** | **X** | **X** |
| 15 | Kha | **√** | **√** | **X** |
| 16 | Lam | **√** | **√** | **√** |
| 17 | Mim | **√** | **√** | **√** |
| 18 | Nun | **X** | **X** | **√** |
| 19 | Qaf | **√** | **√** | **X** |
| 20 | Ra | **√** | **√** | **√** |
| 21 | Sad | **√** | **X** | **√** |
| 22 | Sheen | **√** | **√** | **√** |
| 23 | Sin | **√** | **√** | **√** |
| 24 | Tamarbuto | **√** | **√** | **√** |
| 25 | Ta | **X** | **X** | **X** |
| 26 | Tho | **√** | **√** | **√** |
| 27 | Tsa | **√** | **X** | **√** |
| 28 | Waw | **√** | **X** | **√** |
| 29 | Ya | **X** | **√** | **√** |
| 30 | Za | **√** | **√** | **√** |
| 31 | Lamalif | **X** | **X** | **√** |
| Akurasi | | **74%** | **61%** | **77%** |

1. Hasil Pengujian Huruf dalam Kalimat

Pengujian dengan memasukkan 10 kalimat Arab dalam 3 font yang berbeda ke dalam sistem. Kemudian sistem melakukan penghitungan evaluasi dengan menghasilkan nilai peluang. Nilai peluang yang tertinggi menunjukkan tingkat kemiripan data huruf yang diujikan terhadap basis data yang merupakan hasil pelatihan data latih. Berdasarkan hasil pengenalan dengan hidden markov model, di dapat hasil pengenalan huruf Arab terisolasi dalam tabel IV.5.

Tabel IV.5 Data hasil pengujian pengenalan huruf Arab terisolasi dengan metode hiden markov model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Kalimat** | **Font** | | |
| **Arial Unicode Ms** | **Tahoma** | **Times New Roman** |
| 1 | Kalimat 1 | 54% | 53% | 58% |
| 2 | Kalimat 2 | 52% | 47% | 7% |
| 3 | Kalimat 3 | 55% | 40% | 52% |
| 4 | Kalimat 4 | 43% | 47% | 52% |
| 5 | Kalimat 5 | 38% | 46% | 53% |
| 6 | Kalimat 6 | 54% | 63% | 47% |
| 7 | Kalimat 7 | 33% | 40% | 57% |
| 8 | Kalimat 8 | 78% | 64% | 57% |
| 9 | Kalimat 9 | 25% | 33% | 22% |
| 10 | Kalimat 10 | 54% | 63% | 45% |
| Rata-Rata | | 49% | 50% | 51% |

### **IV. 2 Pembahasan**

Pengujian sistem pengenalan huruf Arab dalam bentuk terisolasi dan dalam kalimat menggunakan neural network dan hidden markov model telah dilaksanakan, sehingga menghasilkan data akurasi. Berdasarkan seluruh data yang terhimpun akan ditampilkan grafik yang membandingkan kedua metode tersebut.

### **IV.2.1 Perbandingan Pengujian Huruf Arab Terisolasi**

Berikut ini merupakan grafik dari hasil pengujian huruf Arab terisolasi

Gambar IV.2 Pengujian huruf Arab terisolasi dalam neural network dan hidden markov model

Grafik di atas merepresentasikan hasil pengenalan huruf Arab terisolasi menggunakan neural network dan hidden markov model berdasarkan pengambilan 31 huruf Arab terisolasi dalam 3 font yang berbeda. Maka hasil pengenalan menggunakan neural network menunjukkan hasil yang lebih baik dibandingkan hidden markov model baik dalam ketiga font. Hasil pengenalan menggunakan neural network mencapai hasil 100% untuk font Arial Unicode Ms, Tahoma dan Times New Roman sedangkan hasil pengenalan menggunakan hidden markov model menghasilkan akurasi 74% untuk font Arial Unicode Ms, 61% untuk font Tahoma dan 77% untuk font Times New Roman.

### **IV.2.2 Perbandingan Pengujian Huruf Arab dalam Kalimat**

Berikut ini merupakan grafik dari hasil pengujian huruf Arab dalam kalimat

Gambar IV.3 Pengujian huruf Arab dalam kalimat dalam neural network dan hidden markov model

Grafik di atas merepresentasikan hasil pengenalan huruf Arab dalam kalimat menggunakan neural network dan hidden markov model, berdasarkan 10 data kalimat dengan 3 font berbeda yang diambil. Maka hasil pengenalan dengan neural network menunjukkan hasil yang lebih baik dalam ketiga font. Hasil pengenalan dengan neural network mencapai akurasi 66% untuk font Arial Unicode Ms, 66% untuk font Tahoma dan 75% untuk font Times New Roman. Sedangkan hasil pengenalan menggunakan hidden markov model mencapai akurasi 49% untuk font Arial Unicode Ms, 50% untuk font Tahoma dan 51%. Hasil pengenalan keseluruhan menunjukkan bahwa font Times New Roman menghasilkan pengenalan yang lebih baik dibandingkan dengan font Arial Unicode Ms dan Thaoma, baik dalam pengenalan dengan neural network dan hidden markov model.

### **IV.2.3 Rekapitulasi Pembahasan dari Seluruh Hasil Pengujian**

Seluruh hasil pengujian kemudian dihitung rata-rata hasil akurasinya, sehingga didapatkan nilai akurasi masing-masing metode berdasarkan pengujian dengan pengenalan huruf terisolasi dan huruf dalam kalimat dalam tabel berikut.

Tabel IV.6 Perbandingan hasil rekapitulasi akurasi

|  |  |  |
| --- | --- | --- |
| Metode | Pengujian | |
| Huruf Terisolasi | Huruf dalam Kalimat |
| Neural Network | 100% | 69% |
| Hidden Markov Model | 71% | 50% |

Dalam pengujian pengenalan huruf Arab terisolasi metode neural network lebih baik jika dibandingkan dengan metode hidden markov model, metode neural network dapat mengenali huruf Arab dengan mencapai akurasi 100%, sedangkan pengenalan menggunakan hidden markov model mencapai 71%. Kemudian berdasarkan pengujian pengenalan huruf Arab dalam kalimat, metode neural network masih lebih baik dibandingkan dengan metode hidden markov model, yakni mencapai akurasi 69%, sedangkan metode hidden markov model mencapai 50%.

Jika diperhatikan berdasarkan masing-masing font, font Times New Roman memiliki keunggulan tingkat pengenalan dibandingkan font Arial Unicode Ms dan font Tahoma, baik dalam pengenalan huruf Arab terisolasi maupun dalam pengenalan huruf Arab dalam kalimat. Pada pengenalan huruf Arab terisolasi dengan metode neural network akurasi pengenalan mencapai 100% untuk seluruh font, sedangkan hidden markov model font Tahoma memiliki akurasi pengenalan paling rendah. Pada pengenalan huruf Arab dalam kalimat dengan metode neural network font Arial Unicode Ms dan font Tahoma memiliki akurasi yang sama, yaitu 66%, ini lebih rendah dibandingkan dengan font Times New Roman yang memiliki akurasi 75%, sedangkan pada hidden markov model Times new Roman memiliki akurasi paling tinggi, disusul oleh font Tahoma dan font Arial Unicode Ms.

Pengenalan huruf Arab dalam kalimat mengalami akurasi yang lebih rendah dibandingkan pengenalan huruf Arab terisolasi. Ini dikarenakan pengenalan huruf Arab dalam kalimat melewati proses segmentasi yang menyebabkan hasil binerisasi huruf data uji sedikit mengalami perbedaan dengan hasil binerisasi data latih, sehingga hasil chain code data latih dan data uji memiliki perbedaan.

Berdasarkan hasil dan analisa didapatkan metode neural network lebih baik untuk digunakan sebagai pengenalan huruf rab dibandingkan metode hidden markov model, baik dalam huruf terisolasi maupun huruf dalam kalimat.

Bab selanjutnya merupakan bab terkahir yang menjelaskan kesimpulan dari hasil penelitian. Selain itu terdapat saran yang dapat dilakukan oleh peneliti selanjutnya.

BAB V Kesimpulan Dan Saran

### **V.1 Kesimpulan**

Dalam penelitian ini telah dilakukan eksperimen untuk mengenali huruf Arab dalam bentuk terisolasi dan dalam kalimat. Perancangan sistem pengenalan huruf Arab ini telah dapat diujikan kepada tulisan Bahasa Arab. Untuk mendapatkan hasil yang paling baik, maka diperlukan perbandingan terhadap metode yang digunakan untuk mengenali huruf Arab. Metode ekstraksi fitur utama yang digunakan adalah chain code yang telah di normalisasi, diikuti dengna jumlah titik dan posisi titik. Kemudian sistem menbandingkan metode klasifikasi neural network dan hidden markov model.

Proses latih mempengaruhi hasil pengenalan terhadap pengenalan huruf Arab terisolasi dan dalam kalimat. Metode neural network dapat mencapai akurasi sebesar 100% untuk pengenalan huruf Arab terisolasi, sedangkan metode hidden markov model dapat mencapai akurasi sebesar 71%. Hasil pengujian pengenalan huruf Arab dalam kalimat menggunakan neural network mencapai akurasi sebesar 69% sedangkan metode hidden markov model mencapai akurasi sebesar 50%.

Setelah dilakukan perbandingan pengenalan huruf Arab pada tulisan cetak dalam posisi terisolasi maupun dalam kalimat dapat disimpulkan bahwa metode neural network lebih baik dibandingkan metode hidden markov model.

### **V.2 Saran**

Dalam penelitian ini akurasi pengenalan huruf Arab dalam kalimat masih lebih rendah dibandingkan dengan akurasi pengenalan huruf Arab terisolasi. Untuk penelitian selanjutnya dapat dikemabngkan ekstraksi fitur tambahan untuk menambah ciri dari masing – masing huruf sehingga akurasi pengenalan menjadi lebih baik.

Sistem pengenalan pengenalan huruf Arab telah banyak dikembangkan baik dalam tulisan cetak maupun tulisan tangan. Namun masih sedikit penelitian tentang pengenalan tulisan Arab dalam kalimat. Oleh karena itu penelitian ini dapat digunakan sebagai dasar implementasi dalam mengembangkan sistem tersebut dengan perbaikan yang ditemukan peneliti selanjtnya. Dengan pengembangan sistem tersebut, diharapkan dimasa depan akan mempermudah proses pembelajaran huruf Arab pada umumnya.

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**LAMPIRAN**

LAMPIRAN A Hasil Ekstraksi Fitur Data Latih

A.1 Hasil Ekstraksi Fitur dengan Font Arial

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Huruf Hasil Thinning** | **Posisi** | **Fitur** | | |
| **Jumlah Titik** | **Posisi Titik** | **Chain code Ter-Normalisasi** |
| 1 | Ain | Terisolasi | 0 | 0 | 1, 8, 6, 5, 4, 8, 6, 6, 4, 4 |
| 2 | Ain | Di awal | 0 | 0 | 1, 8, 8, 6, 4, 4, 8, 8, 8, 8 |
| 3 | Ain | Di tengah | 0 | 0 | 4, 1, 4, 6, 5, 8, 3, 8, 7, 5 |
| 4 | Ain | Di akhir | 0 | 0 | 8, 3, 8, 5, 5, 8, 1, 1, 4, 7 |
| 5 | Alif | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 6, 6 |
| 6 | Alif | Di akhir | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 5, 4 |
| 7 | Ba | Terisolasi | 1 | 2 | 6, 6, 6, 5, 4, 4, 4, 4, 3, 2 |
| 8 | Ba | Di awal | 1 | 2 | 6, 6, 6, 6, 6, 6, 6, 8, 8, 8 |
| 9 | Ba | Di tengah | 1 | 2 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 10 | Ba | Di akhir | 1 | 2 | 6, 6, 4, 4, 4, 3, 2, 6, 5, 4 |
| 11 | Dal | Terisolasi | 0 | 0 | 5, 5, 5, 6, 6, 7, 8, 8, 8, 8 |
| 12 | Dal | Di akhir | 0 | 0 | 6, 6, 6, 6, 5, 4, 1, 1, 8, 8 |
| 13 | Dhad | Terisolasi | 1 | 0 | 6, 3, 6, 8, 4, 2, 7, 6, 8, 2 |
| 14 | Dhad | Di awal | 1 | 0 | 6, 3, 4, 6, 8, 4, 3, 8, 7, 8 |
| 15 | Dhad | Di tengah | 1 | 0 | 6, 2, 4, 5, 8, 4, 8, 1, 7, 8 |
| 16 | Dhad | Di akhir | 1 | 0 | 6, 3, 6, 8, 4, 8, 8, 8, 8, 2 |
| 17 | Dzal | Terisolasi | 1 | 0 | 5, 5, 5, 6, 6, 7, 8, 8, 8, 8 |
| 18 | Dzal | Di akhir | 1 | 0 | 6, 6, 6, 6, 5, 4, 1, 1, 8, 8 |
| 19 | Dzo | Terisolasi | 1 | 0 | 6, 6, 3, 5, 8, 8, 6, 3, 8, 7 |
| 20 | Dzo | Di awal | 1 | 0 | 6, 6, 3, 5, 8, 8, 6, 4, 8, 8 |
| 21 | Dzo | Di tengah | 1 | 0 | 6, 6, 3, 6, 8, 8, 4, 8, 8, 8 |
| 22 | Dzo | Di akhir | 1 | 0 | 6, 6, 3, 6, 8, 8, 4, 8, 1, 8 |
| 23 | Fa | Terisolasi | 1 | 0 | 6, 5, 4, 8, 2, 5, 6, 1, 6, 4 |
| 24 | Fa | Di awal | 1 | 0 | 4, 3, 8, 2, 4, 6, 2, 8, 6, 4 |
| 25 | Fa | Di tengah | 1 | 0 | 4, 1, 4, 6, 4, 4, 1, 1, 7, 6 |
| 26 | Fa | Di akhir | 1 | 0 | 6, 4, 4, 2, 5, 4, 8, 2, 8, 5 |
| 27 | Ghoin | Terisolasi | 1 | 0 | 1, 8, 6, 5, 4, 8, 6, 6, 4, 4 |
| 28 | Ghoin | Di awal | 1 | 0 | 1, 8, 8, 6, 4, 4, 8, 8, 8, 8 |
| 29 | Ghoin | Di tengah | 1 | 0 | 4, 1, 4, 5, 5, 8, 4, 8, 7, 5 |
| 30 | Ghoin | Di akhir | 1 | 0 | 8, 1, 8, 5, 5, 4, 8, 1, 4, 7 |
| 31 | Habesar | Terisolasi | 0 | 0 | 5, 6, 8, 2, 3, 7, 6, 4, 2, 1 |
| 32 | Habesar | Di awal | 0 | 0 | 4, 4, 6, 2, 7, 4, 4, 8, 4, 6 |
| 33 | Habesar | Di tengah | 0 | 0 | 4, 3, 4, 6, 2, 6, 2, 8, 1, 6 |
| 34 | Habesar | Di akhir | 0 | 0 | 6, 6, 8, 2, 3, 7, 6, 4, 2, 2 |
| 35 | Hamzah | Terisolasi | 0 | 0 | 8, 8, 7, 6, 5, 4, 4, 8, 8, 8 |
| 36 | Ha | Terisolasi | 0 | 0 | 4, 4, 7, 7, 6, 6, 5, 4, 4, 4 |
| 37 | Ha | Di awal | 0 | 0 | 4, 4, 4, 4, 5, 8, 8, 8, 8, 8 |
| 38 | Ha | Di tengah | 0 | 0 | 4, 4, 7, 5, 4, 8, 1, 8, 8, 8 |
| 39 | Ha | Di akhir | 0 | 0 | 4, 7, 6, 4, 5, 8, 8, 8, 2, 4 |
| 40 | Jim | Terisolasi | 1 | 1 | 4, 4, 7, 7, 6, 6, 5, 4, 4, 4 |
| 41 | Jim | Di awal | 1 | 1 | 4, 4, 4, 4, 5, 8, 8, 8, 8, 8 |
| 42 | Jim | Di tengah | 1 | 1 | 4, 4, 7, 5, 4, 8, 1, 8, 8, 8 |
| 43 | Jim | Di akhir | 1 | 1 | 4, 7, 6, 4, 5, 8, 1, 8, 2, 4 |
| 44 | Kaf | Terisolasi | 1 | 0 | 6, 6, 6, 6, 6, 7, 8, 8, 1, 2 |
| 45 | Kaf | Di awal | 1 | 0 | 8, 7, 6, 5, 5, 6, 6, 8, 8, 8 |
| 46 | Kaf | Di tengah | 1 | 0 | 8, 7, 6, 5, 6, 4, 8, 4, 8, 1 |
| 47 | Kaf | Di akhir | 1 | 0 | 6, 6, 6, 6, 5, 1, 8, 8, 1, 2 |
| 48 | Kha | Terisolasi | 1 | 0 | 4, 4, 7, 7, 6, 6, 5, 4, 4, 4 |
| 49 | Kha | Di awal | 1 | 0 | 4, 4, 4, 5, 5, 8, 8, 8, 8, 8 |
| 50 | Kha | Di tengah | 1 | 0 | 4, 4, 7, 5, 4, 8, 1, 8, 8, 8 |
| 51 | Kha | Di akhir | 1 | 0 | 4, 7, 6, 4, 5, 8, 1, 8, 2, 4 |
| 52 | Lamalif | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 1, 8, 4, 2, 5 |
| 53 | Lamalif | Di akhir | 0 | 0 | 6, 6, 6, 6, 6, 8, 8, 5, 8, 8 |
| 54 | Lam | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 6, 8, 8, 2, 2 |
| 55 | Lam | Di awal | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 8, 8 |
| 56 | Lam | Di tengah | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 4, 8, 8 |
| 57 | Lam | Di akhir | 0 | 0 | 6, 6, 6, 6, 4, 8, 7, 8, 1, 2 |
| 58 | Mim | Terisolasi | 0 | 0 | 2, 2, 2, 4, 6, 8, 3, 2, 7, 6 |
| 59 | Mim | Di awal | 0 | 0 | 4, 2, 3, 5, 8, 4, 2, 8, 7, 6 |
| 60 | Mim | Di tengah | 0 | 0 | 4, 2, 5, 5, 7, 4, 8, 2, 7, 6 |
| 61 | Mim | Di akhir | 0 | 0 | 8, 1, 6, 3, 6, 2, 4, 8, 4, 6 |
| 62 | Nun | Terisolasi | 1 | 0 | 6, 6, 6, 5, 4, 4, 3, 2, 2, 2 |
| 63 | Nun | Di awal | 1 | 0 | 6, 6, 6, 6, 6, 7, 7, 8, 8, 8 |
| 64 | Nun | Di tengah | 1 | 0 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 65 | Nun | Di akhir | 1 | 0 | 6, 6, 6, 4, 4, 4, 3, 2, 6, 4 |
| 66 | Qaf | Terisolasi | 2 | 0 | 6, 5, 4, 2, 2, 5, 6, 1, 6, 4 |
| 67 | Qaf | Di awal | 2 | 0 | 4, 2, 2, 3, 5, 6, 1, 7, 6, 4 |
| 68 | Qaf | Di tengah | 2 | 0 | 4, 2, 4, 6, 4, 4, 1, 1, 7, 6 |
| 69 | Qaf | Di akhir | 2 | 0 | 6, 4, 3, 1, 3, 6, 8, 1, 6, 4 |
| 70 | Ra | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 6, 7, 8, 8, 8 |
| 71 | Ra | Di akhir | 0 | 0 | 6, 6, 4, 4, 8, 7, 6, 8, 8, 8 |
| 72 | Sad | Terisolasi | 0 | 0 | 6, 3, 6, 8, 4, 2, 7, 6, 8, 2 |
| 73 | Sad | Di awal | 0 | 0 | 6, 3, 4, 6, 8, 4, 3, 8, 7, 8 |
| 74 | Sad | Di tengah | 0 | 0 | 6, 2, 4, 5, 8, 4, 8, 1, 7, 8 |
| 75 | Sad | Di akhir | 0 | 0 | 6, 3, 6, 8, 4, 8, 8, 8, 8, 2 |
| 76 | Sheen | Terisolasi | 3 | 0 | 6, 8, 2, 7, 2, 6, 6, 8, 1, 2 |
| 77 | Sheen | Di awal | 3 | 0 | 6, 6, 8, 2, 6, 8, 1, 2, 6, 8 |
| 78 | Sheen | Di tengah | 3 | 0 | 6, 6, 8, 8, 2, 6, 2, 2, 6, 8 |
| 79 | Sheen | Di akhir | 3 | 0 | 6, 5, 8, 2, 7, 2, 6, 7, 8, 2 |
| 80 | Sin | Terisolasi | 0 | 0 | 6, 8, 2, 7, 2, 6, 6, 8, 1, 2 |
| 81 | Sin | Di awal | 0 | 0 | 6, 6, 8, 2, 6, 6, 1, 2, 6, 8 |
| 82 | Sin | Di tengah | 0 | 0 | 6, 6, 8, 2, 6, 7, 2, 2, 6, 8 |
| 83 | Sin | Di akhir | 0 | 0 | 6, 5, 7, 2, 6, 2, 6, 7, 8, 2 |
| 84 | Tamarbuto | Terisolasi | 2 | 0 | 5, 6, 8, 1, 2, 6, 5, 4, 2, 1 |
| 85 | Tamarbuto | Di akhir | 2 | 0 | 6, 6, 8, 2, 3, 7, 6, 4, 2, 2 |
| 86 | Ta | Terisolasi | 2 | 0 | 6, 6, 6, 5, 4, 4, 4, 4, 3, 2 |
| 87 | Ta | Di awal | 2 | 0 | 6, 6, 6, 6, 6, 6, 6, 8, 8, 8 |
| 88 | Ta | Di tengah | 2 | 0 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 89 | Ta | Di akhir | 2 | 0 | 6, 6, 4, 4, 4, 3, 2, 6, 5, 4 |
| 90 | Tho | Terisolasi | 0 | 0 | 6, 6, 3, 5, 8, 8, 4, 4, 8, 8 |
| 91 | Tho | Di awal | 0 | 0 | 6, 6, 3, 5, 8, 8, 4, 4, 8, 8 |
| 92 | Tho | Di tengah | 0 | 0 | 6, 6, 3, 6, 8, 2, 4, 8, 1, 7 |
| 93 | Tho | Di akhir | 0 | 0 | 6, 6, 3, 6, 8, 8, 4, 8, 1, 8 |
| 94 | Tsa | Terisolasi | 3 | 0 | 6, 6, 6, 5, 4, 4, 4, 4, 3, 2 |
| 95 | Tsa | Di awal | 3 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 8, 8 |
| 96 | Tsa | Di tengah | 3 | 0 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 97 | Tsa | Di akhir | 3 | 0 | 6, 6, 4, 4, 4, 3, 2, 6, 5, 4 |
| 98 | Waw | Terisolasi | 0 | 0 | 4, 4, 2, 1, 7, 4, 8, 2, 5, 6 |
| 99 | Waw | Di akhir | 0 | 0 | 8, 1, 6, 4, 8, 4, 3, 2, 5, 6 |
| 100 | Ya | Terisolasi | 2 | 2 | 1, 8, 7, 5, 5, 7, 8, 8, 1, 2 |
| 101 | Ya | Di awal | 2 | 2 | 6, 6, 6, 6, 6, 7, 7, 8, 8, 8 |
| 102 | Ya | Di tengah | 2 | 2 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 103 | Ya | Di akhir | 2 | 2 | 6, 6, 4, 4, 4, 4, 4, 2, 4, 4 |
| 104 | Za | Terisolasi | 1 | 0 | 6, 6, 6, 6, 6, 6, 7, 8, 8, 8 |
| 105 | Za | Di akhir | 1 | 0 | 6, 6, 4, 4, 8, 7, 6, 8, 8, 8 |

A.2 Hasil Ekstraksi Fitur dengan Font Tahoma

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Huruf Hasil Thinning** | **Posisi** | **Fitur** | | |
| **Jumlah Titik** | **Posisi Titik** | **Chain code Ter-Normalisasi** |
| 1 | Ain | Terisolasi | 0 | 0 | 8, 7, 6, 4, 8, 7, 6, 4, 4, 2 |
| 2 | Ain | Di awal | 0 | 0 | 8, 8, 7, 5, 4, 4, 8, 8, 8, 8 |
| 3 | Ain | Di tengah | 0 | 0 | 4, 1, 4, 6, 5, 4, 1, 2, 8, 5 |
| 4 | Ain | Di akhir | 0 | 0 | 8, 1, 8, 6, 5, 4, 8, 3, 4, 7 |
| 5 | Alif | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 6, 6 |
| 6 | Alif | Di akhir | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 5, 4 |
| 7 | Ba | Terisolasi | 1 | 2 | 6, 6, 7, 8, 8, 8, 8, 1, 2, 2 |
| 8 | Ba | Di awal | 1 | 2 | 6, 6, 6, 6, 6, 6, 6, 8, 8, 8 |
| 9 | Ba | Di tengah | 1 | 2 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 10 | Ba | Di akhir | 1 | 2 | 6, 6, 4, 4, 4, 4, 4, 2, 6, 4 |
| 11 | Dal | Terisolasi | 0 | 0 | 5, 5, 5, 5, 6, 6, 8, 8, 8, 8 |
| 12 | Dal | Di akhir | 0 | 0 | 6, 6, 6, 5, 4, 1, 7, 8, 8, 8 |
| 13 | Dhad | Terisolasi | 1 | 0 | 6, 5, 2, 4, 3, 8, 8, 4, 8, 6 |
| 14 | Dhad | Di awal | 1 | 0 | 6, 3, 4, 7, 8, 4, 4, 1, 7, 8 |
| 15 | Dhad | Di tengah | 1 | 0 | 6, 3, 5, 4, 8, 4, 4, 2, 7, 8 |
| 16 | Dhad | Di akhir | 1 | 0 | 6, 4, 2, 3, 6, 8, 4, 4, 1, 6 |
| 17 | Dzal | Terisolasi | 1 | 0 | 5, 5, 5, 5, 6, 6, 8, 8, 8, 8 |
| 18 | Dzal | Di akhir | 1 | 0 | 6, 6, 6, 5, 4, 1, 7, 8, 8, 8 |
| 19 | Dzo | Terisolasi | 1 | 0 | 6, 6, 3, 6, 8, 8, 6, 4, 1, 8 |
| 20 | Dzo | Di awal | 1 | 0 | 6, 6, 4, 5, 8, 2, 6, 4, 1, 8 |
| 21 | Dzo | Di tengah | 1 | 0 | 6, 6, 3, 6, 8, 2, 6, 4, 2, 8 |
| 22 | Dzo | Di akhir | 1 | 0 | 6, 6, 3, 6, 8, 8, 4, 4, 1, 8 |
| 23 | Fa | Terisolasi | 1 | 0 | 6, 5, 4, 4, 1, 6, 4, 8, 4, 6 |
| 24 | Fa | Di awal | 1 | 0 | 4, 4, 2, 1, 6, 4, 8, 2, 4, 6 |
| 25 | Fa | Di tengah | 1 | 0 | 4, 1, 4, 6, 4, 4, 1, 2, 7, 5 |
| 26 | Fa | Di akhir | 1 | 0 | 6, 4, 4, 2, 6, 4, 4, 3, 8, 5 |
| 27 | Ghoin | Terisolasi | 1 | 0 | 8, 7, 6, 4, 8, 7, 6, 4, 4, 2 |
| 28 | Ghoin | Di awal | 1 | 0 | 8, 8, 7, 5, 4, 4, 8, 8, 8, 8 |
| 29 | Ghoin | Di tengah | 1 | 0 | 4, 1, 4, 6, 5, 4, 1, 2, 8, 5 |
| 30 | Ghoin | Di akhir | 1 | 0 | 8, 1, 8, 6, 5, 4, 8, 3, 4, 7 |
| 31 | Habesar | Terisolasi | 0 | 0 | 4, 5, 6, 1, 2, 7, 6, 4, 2, 1 |
| 32 | Habesar | Di awal | 0 | 0 | 4, 5, 8, 1, 6, 4, 4, 2, 4, 6 |
| 33 | Habesar | Di tengah | 0 | 0 | 4, 2, 5, 7, 2, 7, 7, 3, 8, 6 |
| 34 | Habesar | Di akhir | 0 | 0 | 8, 2, 2, 8, 5, 4, 1, 4, 6, 6 |
| 35 | Hamzah | Terisolasi | 0 | 0 | 8, 8, 7, 6, 5, 4, 4, 8, 8, 8 |
| 36 | Ha | Terisolasi | 0 | 0 | 4, 4, 8, 6, 4, 4, 8, 1, 3, 8 |
| 37 | Ha | Di awal | 0 | 0 | 4, 4, 5, 2, 8, 8, 4, 4, 3, 8 |
| 38 | Ha | Di tengah | 0 | 0 | 4, 4, 2, 4, 8, 8, 4, 8, 3, 8 |
| 39 | Ha | Di akhir | 0 | 0 | 4, 4, 5, 7, 4, 7, 8, 3, 2, 8 |
| 40 | Jim | Terisolasi | 1 | 1 | 4, 4, 8, 6, 4, 4, 8, 1, 3, 8 |
| 41 | Jim | Di awal | 1 | 1 | 4, 4, 4, 7, 8, 8, 4, 4, 3, 8 |
| 42 | Jim | Di tengah | 1 | 1 | 4, 4, 2, 4, 8, 8, 4, 8, 1, 8 |
| 43 | Jim | Di akhir | 1 | 1 | 4, 4, 5, 7, 4, 7, 8, 3, 2, 8 |
| 44 | Kaf | Terisolasi | 1 | 0 | 6, 6, 6, 6, 6, 8, 8, 8, 8, 2 |
| 45 | Kaf | Di awal | 1 | 0 | 7, 6, 5, 5, 6, 6, 8, 8, 8, 8 |
| 46 | Kaf | Di tengah | 1 | 0 | 7, 6, 5, 5, 6, 4, 8, 8, 8, 8 |
| 47 | Kaf | Di akhir | 1 | 0 | 6, 6, 6, 6, 6, 8, 8, 8, 8, 2 |
| 48 | Kha | Terisolasi | 1 | 0 | 4, 4, 8, 6, 4, 4, 8, 1, 3, 8 |
| 49 | Kha | Di awal | 1 | 0 | 4, 4, 4, 7, 8, 8, 4, 4, 3, 8 |
| 50 | Kha | Di tengah | 1 | 0 | 4, 4, 2, 4, 8, 8, 4, 8, 1, 8 |
| 51 | Kha | Di akhir | 1 | 0 | 4, 4, 6, 7, 4, 7, 8, 3, 2, 8 |
| 52 | Lamalif | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 8, 2, 6, 7, 8 |
| 53 | Lamalif | Di akhir | 0 | 0 | 6, 6, 6, 6, 4, 1, 2, 2, 6, 8 |
| 54 | Lam | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 6, 8, 8, 2, 2 |
| 55 | Lam | Di awal | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 6, 8 |
| 56 | Lam | Di tengah | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 5, 1, 8 |
| 57 | Lam | Di akhir | 0 | 0 | 6, 6, 6, 6, 6, 8, 7, 8, 2, 2 |
| 58 | Mim | Terisolasi | 0 | 0 | 4, 3, 3, 5, 8, 1, 4, 2, 7, 6 |
| 59 | Mim | Di awal | 0 | 0 | 4, 2, 4, 6, 8, 5, 4, 2, 7, 6 |
| 60 | Mim | Di tengah | 0 | 0 | 4, 2, 5, 5, 8, 5, 2, 2, 7, 6 |
| 61 | Mim | Di akhir | 0 | 0 | 8, 1, 6, 4, 7, 3, 7, 1, 4, 6 |
| 62 | Nun | Terisolasi | 1 | 0 | 6, 6, 6, 5, 4, 4, 4, 2, 2, 2 |
| 63 | Nun | Di awal | 1 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 8, 8 |
| 64 | Nun | Di tengah | 1 | 0 | 6, 6, 6, 6, 6, 4, 4, 8, 8, 8 |
| 65 | Nun | Di akhir | 1 | 0 | 6, 6, 5, 4, 4, 4, 2, 2, 5, 4 |
| 66 | Qaf | Terisolasi | 2 | 0 | 6, 4, 4, 2, 2, 6, 4, 1, 4, 6 |
| 67 | Qaf | Di awal | 2 | 0 | 4, 4, 2, 1, 6, 4, 8, 2, 4, 6 |
| 68 | Qaf | Di tengah | 2 | 0 | 4, 2, 4, 6, 4, 4, 3, 2, 7, 5 |
| 69 | Qaf | Di akhir | 2 | 0 | 6, 4, 4, 2, 8, 5, 4, 8, 3, 6 |
| 70 | Ra | Terisolasi | 0 | 0 | 5, 6, 6, 6, 6, 6, 7, 8, 8, 8 |
| 71 | Ra | Di akhir | 0 | 0 | 5, 6, 6, 4, 8, 8, 6, 7, 8, 8 |
| 72 | Sad | Terisolasi | 0 | 0 | 6, 5, 2, 4, 3, 8, 8, 4, 8, 6 |
| 73 | Sad | Di awal | 0 | 0 | 6, 3, 4, 7, 8, 4, 4, 1, 7, 8 |
| 74 | Sad | Di tengah | 0 | 0 | 6, 3, 6, 4, 8, 4, 4, 2, 7, 8 |
| 75 | Sad | Di akhir | 0 | 0 | 6, 4, 2, 3, 6, 8, 4, 4, 1, 6 |
| 76 | Sheen | Terisolasi | 3 | 0 | 6, 7, 2, 6, 8, 2, 6, 8, 2, 2 |
| 77 | Sheen | Di awal | 3 | 0 | 6, 6, 8, 2, 6, 8, 2, 7, 3, 6 |
| 78 | Sheen | Di tengah | 3 | 0 | 6, 6, 4, 7, 1, 2, 8, 1, 6, 8 |
| 79 | Sheen | Di akhir | 3 | 0 | 6, 5, 7, 2, 6, 2, 6, 8, 1, 2 |
| 80 | Sin | Terisolasi | 0 | 0 | 6, 7, 2, 6, 8, 2, 6, 8, 2, 2 |
| 81 | Sin | Di awal | 0 | 0 | 6, 6, 8, 2, 6, 8, 1, 2, 3, 6 |
| 82 | Sin | Di tengah | 0 | 0 | 6, 6, 4, 7, 1, 2, 8, 1, 6, 8 |
| 83 | Sin | Di akhir | 0 | 0 | 6, 5, 7, 2, 6, 2, 6, 8, 1, 2 |
| 84 | Tamarbuto | Terisolasi | 2 | 0 | 5, 6, 8, 1, 3, 7, 6, 4, 2, 1 |
| 85 | Tamarbuto | Di akhir | 2 | 0 | 1, 2, 8, 7, 5, 8, 1, 4, 6, 6 |
| 86 | Ta | Terisolasi | 2 | 0 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 87 | Ta | Di awal | 2 | 0 | 6, 6, 6, 6, 6, 6, 6, 8, 8, 8 |
| 88 | Ta | Di tengah | 2 | 0 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 89 | Ta | Di akhir | 2 | 0 | 6, 6, 5, 4, 4, 4, 4, 2, 6, 4 |
| 90 | Tho | Terisolasi | 0 | 0 | 6, 6, 3, 6, 8, 8, 6, 4, 1, 8 |
| 91 | Tho | Di awal | 0 | 0 | 6, 6, 4, 5, 8, 2, 6, 4, 1, 8 |
| 92 | Tho | Di tengah | 0 | 0 | 6, 6, 3, 6, 8, 2, 4, 4, 2, 8 |
| 93 | Tho | Di akhir | 0 | 0 | 6, 6, 3, 6, 8, 8, 6, 4, 1, 8 |
| 94 | Tsa | Terisolasi | 3 | 0 | 6, 6, 7, 8, 8, 8, 8, 1, 2, 2 |
| 95 | Tsa | Di awal | 3 | 0 | 6, 6, 6, 6, 6, 6, 8, 8, 8, 8 |
| 96 | Tsa | Di tengah | 3 | 0 | 6, 6, 6, 6, 4, 4, 8, 8, 8, 8 |
| 97 | Tsa | Di akhir | 3 | 0 | 6, 6, 5, 4, 4, 4, 4, 2, 6, 4 |
| 98 | Waw | Terisolasi | 0 | 0 | 4, 3, 2, 8, 6, 4, 8, 2, 4, 6 |
| 99 | Waw | Di akhir | 0 | 0 | 8, 2, 7, 5, 7, 4, 8, 2, 5, 6 |
| 100 | Ya | Terisolasi | 2 | 2 | 8, 7, 5, 6, 8, 8, 8, 8, 2, 2 |
| 101 | Ya | Di awal | 2 | 2 | 6, 6, 6, 6, 6, 6, 6, 8, 8, 8 |
| 102 | Ya | Di tengah | 2 | 2 | 6, 6, 6, 4, 4, 8, 1, 7, 8, 8 |
| 103 | Ya | Di akhir | 2 | 2 | 6, 5, 4, 4, 4, 2, 2, 4, 5, 4 |
| 104 | Za | Terisolasi | 1 | 0 | 5, 6, 6, 6, 6, 6, 7, 8, 8, 8 |
| 105 | Za | Di akhir | 1 | 0 | 5, 6, 6, 4, 8, 8, 6, 7, 8, 8 |

A.3 Hasil Ekstraksi Fitur dengan Font Times New Roman

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Huruf Hasil Thinning** | **Posisi** | **Fitur** | | |
| **Jumlah Titik** | **Posisi Titik** | **Chain code Ter-Normalisasi** |
| 1 | Ain | Terisolasi | 0 | 0 | 8, 5, 3, 6, 4, 4, 8, 1, 3, 8 |
| 2 | Ain | Di awal | 0 | 0 | 8, 8, 6, 6, 4, 4, 7, 8, 8, 8 |
| 3 | Ain | Di tengah | 0 | 0 | 8, 8, 4, 4, 6, 5, 8, 1, 7, 8 |
| 4 | Ain | Di akhir | 0 | 0 | 4, 5, 4, 6, 4, 8, 1, 3, 8, 8 |
| 5 | Alif | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 6, 6 |
| 6 | Alif | Di akhir | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 4, 4 |
| 7 | Ba | Terisolasi | 1 | 2 | 6, 6, 5, 4, 4, 4, 4, 4, 2, 2 |
| 8 | Ba | Di awal | 1 | 2 | 6, 6, 6, 6, 6, 6, 8, 8, 8, 8 |
| 9 | Ba | Di tengah | 1 | 2 | 6, 6, 6, 6, 6, 6, 8, 8, 8, 8 |
| 10 | Ba | Di akhir | 1 | 2 | 6, 5, 4, 4, 4, 4, 2, 2, 6, 4 |
| 11 | Dal | Terisolasi | 0 | 0 | 5, 5, 6, 6, 8, 8, 8, 8, 1, 2 |
| 12 | Dal | Di akhir | 0 | 0 | 5, 5, 6, 6, 4, 8, 8, 8, 8, 2 |
| 13 | Dhad | Terisolasi | 1 | 0 | 6, 4, 6, 8, 4, 2, 7, 7, 1, 2 |
| 14 | Dhad | Di awal | 1 | 0 | 6, 4, 3, 8, 8, 4, 4, 8, 8, 8 |
| 15 | Dhad | Di tengah | 1 | 0 | 6, 4, 4, 4, 8, 4, 4, 1, 8, 8 |
| 16 | Dhad | Di akhir | 1 | 0 | 6, 4, 6, 8, 4, 8, 7, 6, 1, 2 |
| 17 | Dzal | Terisolasi | 1 | 0 | 5, 5, 6, 6, 8, 8, 8, 8, 1, 2 |
| 18 | Dzal | Di akhir | 1 | 0 | 5, 5, 6, 6, 8, 8, 8, 8, 1, 2 |
| 19 | Dzo | Terisolasi | 1 | 0 | 6, 6, 4, 8, 8, 8, 7, 4, 2, 8 |
| 20 | Dzo | Di awal | 1 | 0 | 6, 6, 4, 6, 8, 8, 4, 4, 1, 8 |
| 21 | Dzo | Di tengah | 1 | 0 | 6, 6, 4, 4, 8, 8, 4, 4, 1, 8 |
| 22 | Dzo | Di akhir | 1 | 0 | 6, 6, 4, 8, 8, 8, 7, 4, 2, 8 |
| 23 | Fa | Terisolasi | 1 | 0 | 6, 5, 4, 4, 4, 1, 4, 2, 7, 5 |
| 24 | Fa | Di awal | 1 | 0 | 4, 4, 2, 2, 8, 5, 4, 1, 4, 6 |
| 25 | Fa | Di tengah | 1 | 0 | 4, 4, 2, 1, 6, 4, 1, 4, 6, 4 |
| 26 | Fa | Di akhir | 1 | 0 | 6, 5, 4, 4, 4, 2, 6, 2, 6, 4 |
| 27 | Ghoin | Terisolasi | 1 | 0 | 8, 5, 3, 6, 4, 4, 8, 1, 3, 8 |
| 28 | Ghoin | Di awal | 1 | 0 | 8, 8, 6, 6, 4, 4, 7, 8, 8, 8 |
| 29 | Ghoin | Di tengah | 1 | 0 | 8, 8, 4, 6, 5, 4, 8, 8, 1, 8 |
| 30 | Ghoin | Di akhir | 1 | 0 | 4, 5, 4, 6, 4, 8, 1, 3, 8, 8 |
| 31 | Habesar | Terisolasi | 0 | 0 | 6, 5, 7, 8, 2, 7, 5, 4, 2, 8 |
| 32 | Habesar | Di awal | 0 | 0 | 6, 5, 8, 3, 3, 4, 6, 5, 2, 1 |
| 33 | Habesar | Di tengah | 0 | 0 | 8, 2, 7, 6, 3, 5, 8, 2, 3, 5 |
| 34 | Habesar | Di akhir | 0 | 0 | 6, 5, 6, 4, 8, 7, 4, 8, 2, 1 |
| 35 | Hamzah | Terisolasi | 0 | 0 | 8, 8, 7, 5, 4, 4, 6, 2, 8, 8 |
| 36 | Ha | Terisolasi | 0 | 0 | 8, 8, 7, 6, 4, 8, 8, 2, 3, 4 |
| 37 | Ha | Di awal | 0 | 0 | 4, 4, 5, 4, 8, 8, 8, 8, 8, 8 |
| 38 | Ha | Di tengah | 0 | 0 | 4, 5, 4, 4, 8, 8, 8, 8, 8, 8 |
| 39 | Ha | Di akhir | 0 | 0 | 8, 8, 6, 4, 4, 8, 2, 4, 6, 4 |
| 40 | Jim | Terisolasi | 1 | 1 | 8, 8, 7, 6, 4, 8, 8, 2, 3, 4 |
| 41 | Jim | Di awal | 1 | 1 | 4, 4, 5, 4, 8, 8, 8, 8, 8, 8 |
| 42 | Jim | Di tengah | 1 | 1 | 4, 4, 6, 4, 8, 8, 8, 8, 8, 8 |
| 43 | Jim | Di akhir | 1 | 1 | 8, 8, 6, 4, 4, 8, 2, 4, 6, 4 |
| 44 | Kaf | Terisolasi | 1 | 0 | 6, 6, 6, 6, 8, 8, 8, 8, 2, 2 |
| 45 | Kaf | Di awal | 1 | 0 | 8, 7, 6, 5, 5, 5, 8, 8, 8, 8 |
| 46 | Kaf | Di tengah | 1 | 0 | 8, 7, 6, 4, 5, 6, 8, 8, 8, 8 |
| 47 | Kaf | Di akhir | 1 | 0 | 6, 6, 6, 6, 8, 8, 8, 8, 2, 2 |
| 48 | Kha | Terisolasi | 1 | 0 | 8, 8, 7, 6, 4, 8, 8, 2, 3, 4 |
| 49 | Kha | Di awal | 1 | 0 | 4, 4, 5, 4, 8, 8, 8, 8, 8, 8 |
| 50 | Kha | Di tengah | 1 | 0 | 4, 4, 6, 4, 8, 8, 8, 8, 8, 8 |
| 51 | Kha | Di akhir | 1 | 0 | 8, 8, 6, 4, 4, 8, 2, 4, 6, 4 |
| 52 | Lamalif | Terisolasi | 0 | 0 | 6, 6, 7, 1, 6, 2, 7, 2, 5, 5 |
| 53 | Lamalif | Di akhir | 0 | 0 | 6, 6, 6, 6, 5, 2, 7, 7, 8, 8 |
| 54 | Lam | Terisolasi | 0 | 0 | 6, 6, 6, 6, 6, 8, 8, 1, 2, 2 |
| 55 | Lam | Di awal | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 6, 8, 8 |
| 56 | Lam | Di tengah | 0 | 0 | 6, 6, 6, 6, 6, 6, 6, 4, 8, 8 |
| 57 | Lam | Di akhir | 0 | 0 | 6, 6, 6, 6, 4, 7, 8, 1, 2, 2 |
| 58 | Mim | Terisolasi | 0 | 0 | 4, 5, 6, 8, 8, 7, 6, 6, 6, 6 |
| 59 | Mim | Di awal | 0 | 0 | 4, 3, 3, 5, 6, 8, 2, 1, 7, 6 |
| 60 | Mim | Di tengah | 0 | 0 | 4, 2, 3, 6, 4, 8, 8, 2, 7, 6 |
| 61 | Mim | Di akhir | 0 | 0 | 4, 5, 4, 4, 8, 8, 8, 6, 6, 6 |
| 62 | Nun | Terisolasi | 1 | 0 | 6, 6, 6, 7, 8, 8, 8, 1, 2, 2 |
| 63 | Nun | Di awal | 1 | 0 | 6, 6, 6, 6, 6, 8, 8, 8, 8, 8 |
| 64 | Nun | Di tengah | 1 | 0 | 6, 6, 6, 6, 6, 4, 8, 8, 8, 8 |
| 65 | Nun | Di akhir | 1 | 0 | 6, 6, 4, 6, 7, 8, 8, 1, 2, 2 |
| 66 | Qaf | Terisolasi | 2 | 0 | 6, 6, 4, 4, 2, 2, 8, 8, 4, 6 |
| 67 | Qaf | Di awal | 2 | 0 | 4, 4, 2, 2, 8, 5, 4, 1, 4, 6 |
| 68 | Qaf | Di tengah | 2 | 0 | 4, 4, 2, 1, 6, 4, 1, 4, 6, 4 |
| 69 | Qaf | Di akhir | 2 | 0 | 6, 6, 4, 4, 2, 2, 5, 8, 5, 4 |
| 70 | Ra | Terisolasi | 0 | 0 | 6, 6, 6, 6, 7, 7, 7, 8, 8, 8 |
| 71 | Ra | Di akhir | 0 | 0 | 6, 6, 6, 4, 7, 7, 7, 8, 8, 8 |
| 72 | Sad | Terisolasi | 0 | 0 | 6, 4, 6, 8, 4, 2, 7, 7, 1, 2 |
| 73 | Sad | Di awal | 0 | 0 | 6, 4, 3, 8, 8, 4, 4, 8, 8, 8 |
| 74 | Sad | Di tengah | 0 | 0 | 6, 4, 4, 4, 8, 4, 4, 1, 8, 8 |
| 75 | Sad | Di akhir | 0 | 0 | 6, 4, 6, 8, 4, 8, 7, 6, 8, 2 |
| 76 | Sheen | Terisolasi | 3 | 0 | 6, 5, 2, 2, 6, 6, 6, 8, 2, 2 |
| 77 | Sheen | Di awal | 3 | 0 | 6, 6, 8, 2, 6, 8, 8, 2, 6, 8 |
| 78 | Sheen | Di tengah | 3 | 0 | 6, 6, 8, 2, 6, 7, 8, 2, 6, 8 |
| 79 | Sheen | Di akhir | 3 | 0 | 6, 4, 2, 2, 6, 6, 7, 8, 1, 2 |
| 80 | Sin | Terisolasi | 0 | 0 | 6, 5, 2, 2, 6, 6, 6, 8, 2, 2 |
| 81 | Sin | Di awal | 0 | 0 | 6, 6, 8, 2, 6, 8, 8, 2, 6, 8 |
| 82 | Sin | Di tengah | 0 | 0 | 6, 6, 8, 2, 6, 7, 8, 2, 6, 8 |
| 83 | Sin | Di akhir | 0 | 0 | 6, 4, 2, 2, 6, 6, 7, 8, 1, 2 |
| 84 | Tamarbuto | Terisolasi | 2 | 0 | 6, 5, 6, 8, 8, 6, 4, 3, 2, 8 |
| 85 | Tamarbuto | Di akhir | 2 | 0 | 6, 5, 6, 4, 8, 3, 4, 8, 2, 1 |
| 86 | Ta | Terisolasi | 2 | 0 | 6, 6, 5, 4, 4, 4, 4, 4, 2, 2 |
| 87 | Ta | Di awal | 2 | 0 | 6, 6, 6, 6, 6, 8, 8, 8, 8, 8 |
| 88 | Ta | Di tengah | 2 | 0 | 6, 6, 6, 6, 4, 8, 8, 8, 8, 8 |
| 89 | Ta | Di akhir | 2 | 0 | 6, 5, 4, 4, 4, 4, 2, 2, 6, 4 |
| 90 | Tho | Terisolasi | 0 | 0 | 6, 6, 4, 8, 8, 8, 7, 4, 2, 8 |
| 91 | Tho | Di awal | 0 | 0 | 6, 6, 4, 6, 8, 8, 4, 4, 1, 8 |
| 92 | Tho | Di tengah | 0 | 0 | 6, 6, 4, 6, 8, 8, 4, 4, 1, 8 |
| 93 | Tho | Di akhir | 0 | 0 | 6, 6, 4, 8, 8, 8, 7, 4, 2, 8 |
| 94 | Tsa | Terisolasi | 3 | 0 | 6, 6, 5, 4, 4, 4, 4, 4, 2, 2 |
| 95 | Tsa | Di awal | 3 | 0 | 6, 6, 6, 6, 6, 6, 8, 8, 8, 8 |
| 96 | Tsa | Di tengah | 3 | 0 | 6, 6, 6, 6, 6, 8, 8, 8, 8, 8 |
| 97 | Tsa | Di akhir | 3 | 0 | 6, 5, 4, 4, 4, 4, 2, 2, 6, 4 |
| 98 | Waw | Terisolasi | 0 | 0 | 4, 4, 3, 2, 1, 6, 4, 1, 4, 6 |
| 99 | Waw | Di akhir | 0 | 0 | 8, 1, 5, 6, 8, 4, 3, 8, 3, 6 |
| 100 | Ya | Terisolasi | 2 | 2 | 1, 7, 6, 4, 7, 8, 8, 1, 2, 2 |
| 101 | Ya | Di awal | 2 | 2 | 6, 6, 6, 6, 6, 8, 8, 8, 8, 8 |
| 102 | Ya | Di tengah | 2 | 2 | 6, 6, 6, 6, 6, 8, 8, 8, 8, 8 |
| 103 | Ya | Di akhir | 2 | 2 | 6, 5, 4, 4, 4, 2, 8, 4, 4, 4 |
| 104 | Za | Terisolasi | 1 | 0 | 6, 6, 6, 6, 7, 7, 7, 8, 8, 8 |
| 105 | Za | Di akhir | 1 | 0 | 6, 6, 6, 5, 7, 7, 7, 8, 8, 8 |