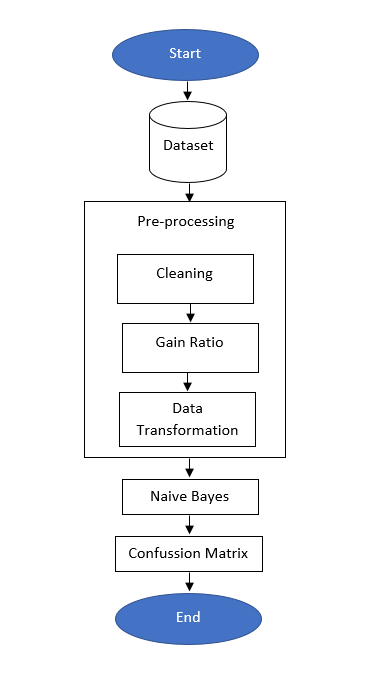
# ANALISA DAN PERANCANGAN

Analisa dan perancangan dilakukan untuk membahas dan menelaah suatu permasalahan yang telah dirumuskan. Analisa yang dilakukan pada penelitian ini yaitu analisa data yang akan dibutuhkan dan analisa proses dalam KDD, sedangkan perancangan yang akan dilakukan dalam penelitian ini yaitu perancangan *database*, dan perancangan antarmuka (*interface*). Berikut tahapan proses dalam KDD pada penerapan metode yang digunakan.



Gambar 4.1 Tahapan KDD

## **Analisa Data**

Pada tahapan analisa data ini dijelaskan proses pengambilan data yang merupakan data sekunder dan atribut pada pengambilan data sebelum di seleksi. Berikut penjelasan dari data sekunder dan atribut data pada analisa data.

### Data Sekunder

Pengambilan data dilakukan dengan mengumpulkan data-data kelulusan mahasiswa Teknik Informatika. Pengumpulan data yang dilakukan pada penelitian ini adalah data sekunder. Data sekuder sendiri merupakan data yang diperoleh menggunakan perantara seperti buku, jurnal dan penelitian sebelumnya. Data yang diperoleh berasal dari Pusat Teknologi Informasi dan Pangkalan Data (PTIPD) Universitas Islam Negeri Sultan Syarif Kasim Riau yang berupa data kelulusan mahasiswa dari tahun 2016 – 2019. *Datasets* utama digunakan untuk melatih data dengan membentuk sebuah model pada algoritma klasifikasi dan membuat pola pengetahuan yang akan digunakan untuk prediksi kelulusan mahasiswa pada kelas data baru. Data prediksi digunakan untuk menguji data baru agar diperoleh pengetahuan pada kelas data baru berdasarkan pada *datasets* utama.

### Atribut Data

Atribut dalam pengambilan data pada penelitian ini adalah atribut data mahasiswa Teknik Informatika Universitas Islam Negeri Sultan Syarif Kasim Riau yang akan di seleksi menggunakan penerapan algoritma seleksi fitur, di antaranya nilai\_sisdig, nilai\_daspro, nilai\_alpro, nilai\_matdis, nilai\_arkom, nilai\_basdat, nilai\_metnum, nilai\_strukdat, nilai\_sbd, nilai\_so, nilai\_jarkom, nilai\_ki, nilai\_rpl, nilai\_si, nilai\_pb dan status kelulusan

## **Analisa Proses KDD**

Berikut merupakan *datasets* utama dan prediksi mahasiswa sebelum dilakukan proses *data mining*. Pada tahapan ini akan dilakukan tahapan-tahapan dalam memprediksi kelulusan mahasiswa berdasarkan data kelulusan mahasiswa Teknik Informatika dari tahun 2016-2019 dengan menggunakan algoritma *naïve bayes* dan *feature* selection *information gain ratio* sebagai penyeleksi atribut. Berikut merupakan *datasets* utama sebelum dilakukan proses *Data Mining* :

Tabel 4.1 *Datasets* Mahasiswa

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **nilai\_sisdig** | **nilai\_daspro** | **nilai\_alpro** | **nilai\_matdis** | **…** | **Status Kelulusan** |
| **1** | C+ | A | B+ | B- | **…** | TERLAMBAT |
| **2** | B | A | B+ | C+ | **…** | TERLAMBAT |
| **3** |  | A | B | B | **…** | TERLAMBAT |
| **4** | B | A | C+ | B- | **…** | TERLAMBAT |
| **5** | B | A | B | C+ | **…** | TERLAMBAT |
| **6** | A- | A | B | B- | **…** | TERLAMBAT |
| **7** | C+ | A | B | A- | **…** | TERLAMBAT |
| **8** | D | A | B | B- | **…** | TERLAMBAT |
| **9** | D | A | A- | B | **…** | TERLAMBAT |
| **10** | A- | A | B+ | B | **…** | TERLAMBAT |
| **…** | … | … | … | … | **…** | **…** |
| **536** | C | E | B | B- | **…** | TERLAMBAT |

### Pembersihan Data (*Data Cleaning*)

Pembersihan data dilakukan dengan memperbaiki data kelulusan mahasiswa sebelum dilakukan proses mining, seperti adanya *missing values* pada data. Dalam hal ini, *missing value* dalam data mahasiswa berasal dari data-data yang atributnya tidak memiliki nilai atau informasi, seperti pada tabel 4.1. Penanganan *missing value* dilakukan dengan mengisi data yang *missing* (kosong) berdasarkan data sebelumnya yang ada pada setiap atribut.

Tabel 4.2 *Datasets* Mahasiswa Setelah Pembersihan

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **nilai\_sisdig** | **nilai\_daspro** | **nilai\_alpro** | **nilai\_matdis** | **…** | **Status Kelulusan** |
| **1** | C+ | A | B+ | B- | **…** | TERLAMBAT |
| **2** | B | A | B+ | C+ | **…** | TERLAMBAT |
| **3** | B | A | B | B | **…** | TERLAMBAT |
| **4** | B | A | C+ | B- | **…** | TERLAMBAT |
| **5** | B | A | B | C+ | **…** | TERLAMBAT |
| **6** | A- | A | B | B- | **…** | TERLAMBAT |
| **7** | C+ | A | B | A- | **…** | TERLAMBAT |
| **8** | D | A | B | B- | **…** | TERLAMBAT |
| **9** | D | A | A- | B | **…** | TERLAMBAT |
| **10** | A- | A | B+ | B | **…** | TERLAMBAT |
| **…** | … | … | … | … | **…** | **…** |
| **536** | C | E | B | B- | **…** | TERLAMBAT |

### Transformasi Data (*Data Transformation*)

*Data transformation* atau transformasi data merupakan tahap dimana mengubah format pada *dataset* ke dalam format yang cocok untuk diproses. Beberapa metode dalam *data mining* memiliki jenis format data yang berbeda-beda. Transformasi data pada penelitian ini akan dilakukan dengan cara konversi dan normalisasi data.

### Konversi Data (*Data Convert*)

Konversi data adalah suatu bentuk teknik mengubah data *string* menjadi angka yang biasa di kenal dengan istilah *encoding*. Dalam hal ini setelah data di seleksi, maka data akan dikonversi dari data pada tipe atribut *non-numerik* ke data *tipe numerik*.

Tabel 4.3 Dataset setelah Di Transformasi

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **nilai\_sisdig** | **nilai\_daspro** | **nilai\_alpro** | **nilai\_matdis** | **…** | **Status Kelulusan** |
| **1** | 2.30 | 4.00 | 3.30 | 2.70 | **…** | TERLAMBAT |
| **2** | 3.00 | 4.00 | 3.30 | 2.30 | **…** | TERLAMBAT |
| **3** | 3.00 | 4.00 | 3.00 | 3.00 | **…** | TERLAMBAT |
| **4** | 3.00 | 4.00 | 2.30 | 2.70 | **…** | TERLAMBAT |
| **5** | 3.00 | 4.00 | 3.00 | 2.30 | **…** | TERLAMBAT |
| **6** | 3.70 | 4.00 | 3.00 | 2.70 | **…** | TERLAMBAT |
| **7** | 2.30 | 4.00 | 3.00 | 3.70 | **…** | TERLAMBAT |
| **8** | 1.00 | 4.00 | 3.00 | 2.70 | **…** | TERLAMBAT |
| **9** | 1.00 | 4.00 | 3.70 | 3.00 | **…** | TERLAMBAT |
| **10** | 3.70 | 4.00 | 3.30 | 3.00 | **…** | TERLAMBAT |
| **…** | … | … | … | … | **…** | **…** |
| **536** | 2.00 | 0.00 | 3.00 | 2.70 | **…** | TERLAMBAT |

### Seleksi Fitur (*Feature Selection*)

Seleksi fitur yang akan dilakukan menggunakan algoritma *gain ratio* yang bertujuan untuk menentukan batas dari kepentingan sebuah atribut. *Gain Ratio* adalah metode pengukuran untuk menimbang atribut dari ruang atribut yang memiliki dimensi tinggi untuk sejumlah besar nilai yang berbeda dan digunakan untuk mengevaluasi atribut yang berhubungan dengan *class*. Pemilihan atribut dengan *Gain Ratio* dilakukan dalam 7 tahapan pada *datasets* tabel 4.3 yaitu :

**Pemisahan Atribut**

Pada *dataset*s, pisahkan masing-masing atribut sesuai dengan kelas nya.

* nilai\_sisdig

Tabel 4.4 Jumlah Data Setiap Kelas Pada Sistem Digital

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 1 | 28 | 38 | 67 |
| 2 | A- | 2 | 25 | 30 | 57 |
| 3 | B+ | 0 | 15 | 34 | 49 |
| 4 | B- | 1 | 10 | 54 | 65 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_daspro

Tabel 4.5 Jumlah Data Setiap Kelas Pada Dasar Pemograman

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 1 | 15 | 40 | 56 |
| 2 | A- | 0 | 16 | 37 | 53 |
| 3 | B+ | 3 | 50 | 72 | 125 |
| 4 | B | 0 | 7 | 73 | 80 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_alpro

Tabel 4.6 Jumlah Data Setiap Kelas Pada Nilai Algoritma Pemograman

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 0 | 9 | 12 | 21 |
| 2 | A- | 1 | 23 | 38 | 62 |
| 3 | B | 2 | 21 | 92 | 115 |
| 4 | B- | 1 | 11 | 65 | 77 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_matdis

Tabel 4.7 Jumlah Data Setiap Kelas Pada Nilai Matematika Diskrit

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A- | 1 | 16 | 28 | 45 |
| 2 | B+ | 1 | 28 | 44 | 73 |
| 3 | B | 1 | 35 | 102 | 138 |
| 4 | B- | 1 | 14 | 100 | 115 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_arkom

Tabel 4.8 Jumlah Data Setiap Kelas Pada Nilai Artimatika Komputer

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 2 | 40 | 45 | 87 |
| 2 | A- | 2 | 21 | 52 | 75 |
| 3 | B+ | 0 | 10 | 70 | 80 |
| 4 | B | 0 | 12 | 45 | 57 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_basdat

Tabel 4.9 Jumlah Data Setiap Kelas Pada Nilai Basis Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A- | 1 | 39 | 44 | 84 |
| 2 | B | 1 | 9 | 62 | 72 |
| 3 | C+ | 1 | 30 | 105 | 136 |
| 4 | E | 1 | 6 | 0 | 7 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_metnum

Tabel 4.10 Jumlah Data Setiap Kelas Pada Nilai Matematika Numerik

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 1 | 20 | 13 | 34 |
| 2 | A- | 1 | 26 | 31 | 58 |
| 3 | B- | 1 | 7 | 74 | 82 |
| 4 | C+ | 1 | 6 | 65 | 72 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_strukdat

Tabel 4.11 Jumlah Data Setiap Kelas Pada Nilai Struktur Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | B | 1 | 21 | 70 | 92 |
| 2 | B- | 2 | 17 | 73 | 92 |
| 3 | C+ | 0 | 22 | 69 | 91 |
| 4 | C | 1 | 17 | 60 | 78 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_sbd

Tabel 4.12 Jumlah Data Setiap Kelas Pada Nilai Sistem Basis Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 2 | 16 | 19 | 37 |
| 2 | B+ | 1 | 23 | 101 | 125 |
| 3 | D | 1 | 5 | 9 | 15 |
| 4 | E | 0 | 0 | 16 | 16 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_so

Tabel 4.13 Jumlah Data Setiap Kelas Pada Sistem Operasi

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 0 | 30 | 32 | 62 |
| 2 | A- | 1 | 19 | 37 | 57 |
| 3 | B+ | 2 | 19 | 48 | 69 |
| 4 | B- | 1 | 8 | 66 | 67 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_jarkom

Tabel 4.14 Jumlah Data Setiap Kelas Pada Nilai Jaringan Komputer

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 1 | 26 | 35 | 62 |
| 2 | B+ | 2 | 15 | 38 | 55 |
| 3 | B | 0 | 14 | 55 | 69 |
| 4 | B- | 1 | 27 | 86 | 114 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_ki

Tabel 4.15 Jumlah Data Setiap Kelas Pada Nilai Keamanan Informasi

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 0 | 9 | 20 | 29 |
| 2 | A- | 0 | 23 | 81 | 104 |
| 3 | B+ | 4 | 49 | 69 | 122 |
| 4 | B | 1 | 23 | 101 | 124 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_rpl

Tabel 4.16 Jumlah Data Setiap Kelas Pada Rekayasa Perangkat Lunak

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A- | 3 | 21 | 24 | 48 |
| 2 | B+ | 0 | 30 | 72 | 102 |
| 3 | B | 0 | 27 | 66 | 93 |
| 4 | B- | 1 | 11 | 61 | 73 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_si

Tabel 4.17 Jumlah Data Setiap Kelas Pada Nilai Sistem Informasi

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A | 0 | 14 | 8 | 22 |
| 2 | A- | 2 | 43 | 54 | 99 |
| 3 | B+ | 2 | 36 | 97 | 135 |
| 4 | B | 0 | 19 | 113 | 132 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

* nilai\_pb

Tabel 4.18 Jumlah Data Setiap Kelas Pada Nilai Pemograman Bergerak

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** |
| 1 | A- | 0 | 9 | 75 | 22 |
| 2 | B+ | 3 | 55 | 57 | 99 |
| 3 | B | 0 | 17 | 69 | 135 |
| 4 | B- | 1 | 14 | 83 | 132 |
| ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |

**Perhitungan *Entropy***

Perhitungan *entropy* dilakukan dengan menggunakan persamaan (2.2) setiap masing-masing atribut. Berikut perhitungan *entropy:*

* nilai\_sisdig

Tabel 4.19 Nilai Entropy Dari Data Nilai Sistem Digital

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 1 | 28 | 38 | 67 | 1,080608842 |
| 2 | A- | 2 | 25 | 30 | 57 | 1,178449267 |
| 3 | B+ | 0 | 15 | 34 | 49 | 0,88864667 |
| 4 | B- | 1 | 10 | 54 | 65 | 0,811278124 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_daspro

Tabel 4.20 Nilai Entropy Dari Data Dasar Pemograman

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 1 | 15 | 40 | 56 | 0,959489 |
| 2 | A- | 0 | 16 | 37 | 53 | 0,883585 |
| 3 | B+ | 3 | 50 | 72 | 125 | 1,116326 |
| 4 | B | 0 | 7 | 73 | 80 | 0,42807 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_alpro

Tabel 4.21 Nilai Entropy Dari Data Nilai Algoritma Pemograman

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 0 | 9 | 12 | 21 | 0,985228136 |
| 2 | A- | 1 | 23 | 38 | 62 | 1,059629044 |
| 3 | B | 2 | 21 | 92 | 115 | 0,807173826 |
| 4 | B- | 1 | 11 | 65 | 77 | 0,688765039 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_matdis

Tabel 4.22 Nilai Entropy Dari Data Nilai Matematika Diskrit

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A- | 1 | 16 | 28 | 45 | 1,078387811 |
| 2 | B+ | 1 | 28 | 44 | 73 | 1,055291284 |
| 3 | B | 1 | 35 | 102 | 138 | 0,8758267 |
| 4 | B- | 1 | 14 | 100 | 115 | 0,604719721 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_arkom

Tabel 4.23 Nilai Entropy Dari Data Nilai Artimatika Komputer

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 2 | 40 | 45 | 87 | 1,132477828 |
| 2 | A- | 2 | 21 | 52 | 75 | 1,019998274 |
| 3 | B+ | 0 | 10 | 70 | 80 | 0,543564443 |
| 4 | B | 0 | 12 | 45 | 57 | 0,74248757 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_basdat

Tabel 4.24 Nilai Entropy Dari Data Pada Nilai Basis Data

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A- | 1 | 39 | 44 | 84 | 1,07867840187794 |
| 2 | B | 1 | 9 | 62 | 72 | 0,646459775651103 |
| 3 | C+ | 1 | 30 | 105 | 136 | 0,821268008726821 |
| 4 | E | 1 | 6 | 0 | 7 | 0,591672778582327 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_metnum

Tabel 4.25 Nilai Entropy Dari Data Pada Nilai Matematika Numerik

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 1 | 20 | 13 | 34 | 1,130278187 |
| 2 | A- | 1 | 26 | 31 | 58 | 1,102954818 |
| 3 | B- | 1 | 7 | 74 | 82 | 0,514246718 |
| 4 | C+ | 1 | 6 | 65 | 72 | 0,517651629 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_strukdat

Tabel 4.25 Nilai Entropy Dari Data Pada Nilai Struktur Data

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | B | 1 | 21 | 70 | 92 | 0,857382858 |
| 2 | B- | 2 | 17 | 73 | 92 | 0,835039553 |
| 3 | C+ | 0 | 22 | 69 | 91 | 0,797951968 |
| 4 | C | 1 | 17 | 60 | 78 | 0,850782936 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_sbd

Tabel 4.26 Nilai Entropy Dari Data Pada Nilai Sistem Basis Data

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 2 | 16 | 19 | 37 | 1,244301 |
| 2 | B+ | 1 | 23 | 101 | 125 | 0,753614 |
| 3 | D | 1 | 5 | 9 | 15 | 1,23096 |
| 4 | E | 0 | 0 | 16 | 16 | 0 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_so

Tabel 4.27 Nilai Entropy Dari Data Pada Sistem Operasi

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 0 | 30 | 32 | 62 | 0,999249 |
| 2 | A- | 1 | 19 | 37 | 57 | 1,035339 |
| 3 | B+ | 2 | 19 | 48 | 69 | 1,024628 |
| 4 | B- | 1 | 8 | 66 | 67 | 0,879459 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_jarkom

Tabel 4.28 Nilai Entropy Dari Data Jaringan Komputer

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 1 | 26 | 35 | 62 | 1,087481177 |
| 2 | B+ | 2 | 15 | 38 | 55 | 0,852405179 |
| 3 | B | 0 | 14 | 55 | 69 | 1,053639633 |
| 4 | B- | 1 | 27 | 86 | 114 | 0,727687455 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_ki

Tabel 4.29 Nilai Entropy Dari Data Keamanan Informasi

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 0 | 9 | 20 | 29 | 0,893571 |
| 2 | A- | 0 | 23 | 81 | 104 | 0,762269 |
| 3 | B+ | 4 | 49 | 69 | 122 | 1,155254 |
| 4 | B | 1 | 23 | 101 | 124 | 0,691928 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_rpl

Tabel 4.30 Nilai Entropy Dari Data Rekayasa Perangkat Lunak

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A- | 3 | 21 | 24 | 48 | 1,271782 |
| 2 | B+ | 0 | 30 | 72 | 102 | 0,873981 |
| 3 | B | 0 | 27 | 66 | 93 | 0,869138 |
| 4 | B- | 1 | 11 | 61 | 73 | 0,712719 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_si

Tabel 4.31 Nilai Entropy Dari Data Sistem Informasi

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A | 0 | 14 | 8 | 22 | 0,94566 |
| 2 | A- | 2 | 43 | 54 | 99 | 1,113263 |
| 3 | B+ | 2 | 36 | 97 | 135 | 0,941195 |
| 4 | B | 0 | 19 | 113 | 132 | 0,594463 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

* nilai\_pb

Tabel 4.32 Nilai Entropy Dari Data Pemograman Bergerak

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Tepat Waktu** | **Sedang** | **Terlambat** | **Total** | ***Entropy*** |
| 1 | A- | 0 | 9 | 75 | 22 | 0,491237 |
| 2 | B+ | 3 | 55 | 57 | 99 | 1,14806 |
| 3 | B | 0 | 17 | 69 | 135 | 0,717252 |
| 4 | B- | 1 | 14 | 83 | 132 | 0,671534 |
| ... | ... | ... | ... | ... | ... | ... |
| Total | | 4 | 532 | 536 | 536 |  |

**Perhitungan *Information Gain***

Setelah mendapatkan nilai *entropy* dari masing-masing atribut, langkah selanjutnya yaitu menghitung *information gain*. *Information gain* dapat dihitung dengan menggunakan persamaan (2.2). Berikut ini perhitungan *information gain*

* nilai\_sisdig
* 0,082807067

Tabel 4.33 Nilai *information Gain* Nilai Sistem Digital

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 67 | 1,080608842 | 0,082807067 |
| 2 | A- | 57 | 1,178449267 |
| 3 | B+ | 49 | 0,88864667 |
| 4 | B- | 65 | 0,811278124 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_daspro

Tabel 4.34 Nilai *information Gain* Nilai Dasar Pemograman

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 56 | 0,959489 | 0,0786648614074782 |
| 2 | A- | 53 | 0,883585 |
| 3 | B+ | 125 | 1,116326 |
| 4 | B | 80 | 0,42807 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_alpro

Tabel 4.35 Nilai *information Gain* Nilai Algoritma Pemograman

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 21 | 0,985228136 | 0,0431451712905655 |
| 2 | A- | 62 | 1,059629044 |
| 3 | B | 115 | 0,807173826 |
| 4 | B- | 77 | 0,688765039 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_matdis

Tabel 4.36 Nilai *information Gain* Nilai Matematika Diskrit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A- | 45 | 1,078387811 | 0,0848924831795079 |
| 2 | B+ | 73 | 1,055291284 |
| 3 | B | 138 | 0,8758267 |
| 4 | B- | 115 | 0,604719721 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_arkom

Tabel 4.37 Nilai *information Gain* Nilai Artimatika Komputer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 87 | 1,132477828 | 0,0716569756205184 |
| 2 | A- | 75 | 1,019998274 |
| 3 | B+ | 80 | 0,543564443 |
| 4 | B | 57 | 0,74248757 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_basdat

Tabel 4.38 Nilai *information Gain* Nilai Basis Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A- | 84 | 1,07867840187794 | 0,0972294440547119 |
| 2 | B | 72 | 0,646459775651103 |
| 3 | C+ | 136 | 0,821268008726821 |
| 4 | E | 7 | 0,591672778582327 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_metnum

Tabel 4.39 Nilai *information Gain* Nilai Matematika Numerik

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 34 | 1,130278187 | 0,116979662057723 |
| 2 | A- | 58 | 1,102954818 |
| 3 | B- | 82 | 0,514246718 |
| 4 | C+ | 72 | 0,517651629 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_strukdat

Tabel 4.40 Nilai *information Gain* Nilai Struktur Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | B | 92 | 0,857382858 | 0,0395821560518723 |
| 2 | B- | 92 | 0,835039553 |
| 3 | C+ | 91 | 0,797951968 |
| 4 | C | 78 | 0,850782936 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_sbd

Tabel 4.41 Nilai *information Gain* Nilai Sistem Basis Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 37 | 1,244301 | 0,0713660153128347 |
| 2 | B+ | 125 | 0,753614 |
| 3 | D | 15 | 1,23096 |
| 4 | E | 16 | 0 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_so

Tabel 4.42 Nilai *information Gain* Nilai Sistem Operasi

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 62 | 0,999249 | 0,0825601088507555 |
| 2 | A- | 57 | 1,035339 |
| 3 | B+ | 69 | 1,024628 |
| 4 | B- | 67 | 0,879459 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_jarkom

Tabel 4.43 Nilai *information Gain* Nilai Jaringan Komputer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 62 | 1,087481177 | 0,0451689999413816 |
| 2 | B+ | 55 | 0,852405179 |
| 3 | B | 69 | 1,053639633 |
| 4 | B- | 114 | 0,727687455 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_ki

Tabel 4.44 Nilai *information Gain* Nilai Keamanan Informasi

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 29 | 0,893571 | 0,088168051317114 |
| 2 | A- | 104 | 0,762269 |
| 3 | B+ | 122 | 1,155254 |
| 4 | B | 124 | 0,691928 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_rpl

Tabel 4.45 Nilai *information Gain* Nilai Rekayasa Perangkat Lunak

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A- | 48 | 1,271782 | 0,102284803787748 |
| 2 | B+ | 102 | 0,873981 |
| 3 | B | 93 | 0,869138 |
| 4 | B- | 73 | 0,712719 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_si

Tabel 4.46 Nilai *information Gain* Nilai Sistem Informasi

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A | 22 | 0,94566 | 0,125213823464582 |
| 2 | A- | 99 | 1,113263 |
| 3 | B+ | 135 | 0,941195 |
| 4 | B | 132 | 0,594463 |
| ... | ... | ... | ... |
| Total | | 536 |  |

* nilai\_pb

Tabel 4.47 Nilai *information Gain* Nilai Pemograman Bergerak

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Entropy*** | ***Information Gain*** |
| 1 | A- | 22 | 0,491237 | 0,0889260285678869 |
| 2 | B+ | 99 | 1,14806 |
| 3 | B | 135 | 0,717252 |
| 4 | B- | 132 | 0,671534 |
| ... | ... | ... | ... |
| Total | | 536 |  |

**Perhitungan Split Information**

Pada tahap ini dilakukan perhitungan *split information* dari masing-masing atribut. Perhitungan *split information* ini dilakukan dengan menggunakan persamaan (2.5). Berikut ini perhitungan *split information*.

* nilai\_sisdig
* 0,375
* 0,343829017
* 0,369108003

Tabel 4.33 Nilai *information Gain* Nilai Sistem Digital

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 67 | 0,082807067 | 0,375 |
| 2 | A- | 57 | 0,343829017 |
| 3 | B+ | 49 | 0,315517888 |
| 4 | B- | 65 | 0,369108003 |
| ... | ... | ... | ... |
| Total | | 536 | 3,163006836 |

* nilai\_daspro
* 0,340464774
* 0,330080118
* 0,489809913

Tabel 4.34 Nilai *information Gain* Nilai Dasar Pemograman

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 56 | 0,0786648614074782 | 0,340464774 |
| 2 | A- | 53 | 0,330080118 |
| 3 | B+ | 125 | 0,489809913 |
| 4 | B | 80 | 0,409576283 |
| ... | ... | ... | ... |
| Total | | 536 | 2,93524181 |

* nilai\_alpro
* 0,183114192
* 0,359957759
* 0,492220843

Tabel 4.35 Nilai *information Gain* Nilai Algoritma Pemograman

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 21 | 0,0431451712905655 | 0,183114192 |
| 2 | A- | 62 | 0,359957759 |
| 3 | B | 115 | 0,476434517 |
| 4 | B- | 77 | 0,402138627 |
| ... | ... | ... | ... |
| Total | | 536 | 2,765925773 |

* nilai\_matdis
* *0,177020936*
* *0,300075791*
* *0,391730071*

Tabel 4.36 Nilai *information Gain* Nilai Matematika Diskrit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A- | 45 | 0,0848924831795079 | 0,300075791 |
| 2 | B+ | 73 | 0,391730071 |
| 3 | B | 138 | 0,503999875 |
| 4 | B- | 115 | 0,476434517 |
| ... | ... | ... | ... |
| Total | | 536 | 2,822332524 |

* nilai\_arkom
* 0,425771783
* 0,397006133
* 0,409576283

Tabel 4.37 Nilai *information Gain* Nilai Artimatika Komputer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 87 | 0,0716569756205184 | 0,425771783 |
| 2 | A- | 75 | 0,397006133 |
| 3 | B+ | 80 | 0,409576283 |
| 4 | B | 57 | 0,343829017 |
| ... | ... | ... | ... |
| Total | | 536 | 3,038384869 |

* nilai\_basdat
* 0,107167185
* 0,419023934
* 0,353641634

Tabel 4.38 Nilai *information Gain* Nilai Basis Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A- | 84 | 0,0972294440547119 | 0,419023934 |
| 2 | B | 72 | 0,389036981 |
| 3 | C+ | 136 | 0,502039521 |
| 4 | E | 7 | 0,081737201 |
| ... | ... | ... | ... |
| Total | | 536 | 2,793292399 |

* nilai\_metnum

0,252375552

0,347146036

0,414365764

Tabel 4.39 Nilai *information Gain* Nilai Matematika Numerik

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 34 | 0,116979662057723 | 0,252375552 |
| 2 | A- | 58 | 0,347146036 |
| 3 | B- | 82 | 0,414365764 |
| 4 | C+ | 72 | 0,389036981 |
| ... | ... | ... | ... |
| Total | | 536 | 3,04913678 |

* nilai\_strukdat
* 0,30402286
* *0,333591215*
* 0,30402286

Tabel 4.40 Nilai *information Gain* Nilai Struktur Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | B | 92 | 0,0395821560518723 | 0,436403928 |
| 2 | B- | 92 | 0,436403928 |
| 3 | C+ | 91 | 0,434337321 |
| 4 | C | 78 | 0,404652209 |
| ... | ... | ... | ... |
| Total | | 536 | 2,977770247 |

* nilai\_sbd
* *0,266222995*
* *0,356821759*
* 0,489809913

Tabel 4.41 Nilai *information Gain* Nilai Sistem Basis Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 37 | 0,0713660153128347 | 0,266222995 |
| 2 | B+ | 125 | 0,489809913 |
| 3 | D | 15 | 0,144380558 |
| 4 | E | 16 | 0,151226543 |
| ... | ... | ... | ... |
| Total | | 536 | 2,893170399 |

* nilai\_so
* 0,343829017
* *0,343829017*
* 0,380731281

Tabel 4.42 Nilai *information Gain* Nilai Sistem Operasi

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 62 | 0,0825601088507555 | 0,359957759 |
| 2 | A- | 57 | 0,343829017 |
| 3 | B+ | 69 | 0,380731281 |
| 4 | B- | 67 | 0,397006133 |
| ... | ... | ... | ... |
| Total | | 536 | 3,099264091 |

* nilai\_jarkom
* 0,359957759
* *0,337052465*
* 0,380731281

Tabel 4.43 Nilai *information Gain* Nilai Jaringan Komputer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 62 | 0,0451689999413816 | 0,359957759 |
| 2 | B+ | 55 | 0,337052465 |
| 3 | B | 69 | 0,380731281 |
| 4 | B- | 114 | 0,474971467 |
| ... | ... | ... | ... |
| Total | | 536 | 3,032598364 |

* nilai\_ki

Tabel 4.44 Nilai *information Gain* Nilai Keamanan Informasi

* *0,227677496*
* 0,459006614

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 29 | 0,088168051317114 | 0,227677496 |
| 2 | A- | 104 | 0,459006614 |
| 3 | B+ | 122 | 0,486031578 |
| 4 | B | 124 | 0,488572233 |
| ... | ... | ... | ... |
| Total | | 536 | 2,652790688 |

* nilai\_rpl
* *0,311742689*
* *0,455510658*
* 0,438441279

Tabel 4.45 Nilai *information Gain* Nilai Rekayasa Perangkat Lunak

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A- | 48 | 0,102284803787748 | 0,311742689 |
| 2 | B+ | 102 | 0,455510658 |
| 3 | B | 93 | 0,438441279 |
| 4 | B- | 73 | 0,391730071 |
| ... | ... | ... | ... |
| Total | | 536 | 3,000891772 |

* nilai\_si
* 0,189079229
* 0,450068143
* 0,50102973

Tabel 4.46 Nilai *information Gain* Nilai Sistem Informasi

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A | 22 | 0,125213823464582 | 0,189079229 |
| 2 | A- | 99 | 0,450068143 |
| 3 | B+ | 135 | 0,50102973 |
| 4 | B | 132 | 0,497880129 |
| ... | ... | ... | ... |
| Total | | 536 | 2,65613625 |

* nilai\_pb
* *0,419023934*
* *0,476434517*
* *0,423553921*

Tabel 4.47 Nilai *information Gain* Nilai Pemograman Bergerak

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** |
| 1 | A- | 22 | 0,0889260285678869 | 0,419023934 |
| 2 | B+ | 99 | 0,476434517 |
| 3 | B | 135 | 0,423553921 |
| 4 | B- | 132 | 0,448199955 |
| ... | ... | ... | ... |
| Total | | 536 | 2,827028575 |

**Perhitungan** **Gain Ratio**

Pada tahap ini dilakukan perhitungan *Gain Ratio* dari masing-masing atribut. Perhitungan *Gain Ratio* ini dilakukan dengan menggunakan persamaan (2.4). Berikut ini perhitungan *Gain Ratio*.

* nilai\_sisdig

Tabel 4.48 Nilai *Gain Ratio* Nilai Sistem Digital

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 67 | 0,082807067 | 0,375 | 0,026179857 |
| 2 | A- | 57 | 0,343829017 |
| 3 | B+ | 49 | 0,315517888 |
| 4 | B- | 65 | 0,369108003 |
| ... | ... | ... | ... |
| Total | | 536 | 3,163006836 |

* nilai\_daspro

Tabel 4.49 Nilai *Gain Ratio* Nilai Dasar Pemograman

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 56 | 0,0786648614074782 | 0,340464774 | 0,02680013 |
| 2 | A- | 53 | 0,330080118 |
| 3 | B+ | 125 | 0,489809913 |
| 4 | B | 80 | 0,409576283 |
| ... | ... | ... | ... |
| Total | | 536 | 2,93524181 |

* nilai\_alpro
* 0,015598817

Tabel 4.50 Nilai *Gain Ratio* Nilai Algoritma Pemograman

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 21 | 0,0431451712905655 | 0,183114192 | 0,015598817 |
| 2 | A- | 62 | 0,359957759 |
| 3 | B | 115 | 0,476434517 |
| 4 | B- | 77 | 0,402138627 |
| ... | ... | ... | ... |
| Total | | 536 | 2,765925773 |

* nilai\_matdis
* 0,015598817

Tabel 4.51 Nilai *Gain Ratio* Nilai Matematika Diskrit

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A- | 45 | 0,0848924831795079 | 0,300075791 | 0,015598817 |
| 2 | B+ | 73 | 0,391730071 |
| 3 | B | 138 | 0,503999875 |
| 4 | B- | 115 | 0,476434517 |
| ... | ... | ... | ... |
| Total | | 536 | 2,822332524 |

* nilai\_arkom

0,0235839

Tabel 4.52 Nilai *Gain Ratio* Artimatika Komputer

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 87 | 0,0716569756205184 | 0,425771783 | 0,0235839 |
| 2 | A- | 75 | 0,397006133 |
| 3 | B+ | 80 | 0,409576283 |
| 4 | B | 57 | 0,343829017 |
| ... | ... | ... | ... |
| Total | | 536 | 3,038384869 |

* nilai\_basdat
* 0,034808187

Tabel 4.53 Nilai *Gain Ratio* Basis Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A- | 84 | 0,0972294440547119 | 0,419023934 | 0,034808187 |
| 2 | B | 72 | 0,389036981 |
| 3 | C+ | 136 | 0,502039521 |
| 4 | E | 7 | 0,081737201 |
| ... | ... | ... | ... |
| Total | | 536 | 2,793292399 |

* nilai\_metnum
* 0,038364846

Tabel 4.54 Nilai *Gain Ratio* Matematika Numerik

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 34 | 0,116979662057723 | 0,252375552 | 0,038364846 |
| 2 | A- | 58 | 0,347146036 |
| 3 | B- | 82 | 0,414365764 |
| 4 | C+ | 72 | 0,389036981 |
| ... | ... | ... | ... |
| Total | | 536 | 3,04913678 |

* nilai\_strukdat
* 0,013292549

Tabel 4.55 Nilai *Gain Ratio* Struktur Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | B | 92 | 0,0395821560518723 | 0,436403928 | 0,013292549 |
| 2 | B- | 92 | 0,436403928 |
| 3 | C+ | 91 | 0,434337321 |
| 4 | C | 78 | 0,404652209 |
| ... | ... | ... | ... |
| Total | | 536 | 2,977770247 |

* nilai\_sbd
* 0,024667063

Tabel 4.56 Nilai *Gain Ratio* Sistem Basis Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 37 | 0,0713660153128347 | 0,266222995 | 0,024667063 |
| 2 | B+ | 125 | 0,489809913 |
| 3 | D | 15 | 0,144380558 |
| 4 | E | 16 | 0,151226543 |
| ... | ... | ... | ... |
| Total | | 536 | 2,893170399 |

* nilai\_so
* 0,026638617

Tabel 4.57 Nilai *Gain Ratio* Sistem Operasi

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 62 | 0,0825601088507555 | 0,359957759 | 0,026638617 |
| 2 | A- | 57 | 0,343829017 |
| 3 | B+ | 69 | 0,380731281 |
| 4 | B- | 67 | 0,397006133 |
| ... | ... | ... | ... |
| Total | | 536 | 3,099264091 |

* nilai\_jarkom
* 0,014894488

Tabel 4.58 Nilai *Gain Ratio* Jaringan Komputer

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 62 | 0,0451689999413816 | 0,359957759 | 0,014894488 |
| 2 | B+ | 55 | 0,337052465 |
| 3 | B | 69 | 0,380731281 |
| 4 | B- | 114 | 0,474971467 |
| ... | ... | ... | ... |
| Total | | 536 | 3,032598364 |

* nilai\_ki

Tabel 4.59 Nilai *Gain Ratio* Keamanan Informasi

* 0,033235962

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 29 | 0,088168051317114 | 0,227677496 | 0,033235962 |
| 2 | A- | 104 | 0,459006614 |
| 3 | B+ | 122 | 0,486031578 |
| 4 | B | 124 | 0,488572233 |
| ... | ... | ... | ... |
| Total | | 536 | 2,652790688 |

* nilai\_rpl
* 0,034084803

Tabel 4.60 Nilai *Gain Ratio* Rekayasa Perangkat Lunak

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A- | 48 | 0,102284803787748 | 0,311742689 | 0,034084803 |
| 2 | B+ | 102 | 0,455510658 |
| 3 | B | 93 | 0,438441279 |
| 4 | B- | 73 | 0,391730071 |
| ... | ... | ... | ... |
| Total | | 536 | 3,000891772 |

* nilai\_si
* 0,047141341

Tabel 4.61 Nilai *Gain Ratio* Sistem Informasi

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A | 22 | 0,125213823464582 | 0,189079229 | 0,047141341 |
| 2 | A- | 99 | 0,450068143 |
| 3 | B+ | 135 | 0,50102973 |
| 4 | B | 132 | 0,497880129 |
| ... | ... | ... | ... |
| Total | | 536 | 2,65613625 |

* nilai\_pb
* 0,031455653

Tabel 4.62 Nilai *Gain Ratio* Pemograman Bergerak

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Nilai** | **Total** | ***Information Gain*** | ***Split Information*** | ***Gain Ratio*** |
| 1 | A- | 22 | 0,0889260285678869 | 0,419023934 | 0,031455653 |
| 2 | B+ | 99 | 0,476434517 |
| 3 | B | 135 | 0,423553921 |
| 4 | B- | 132 | 0,448199955 |
| ... | ... | ... | ... |
| Total | | 536 | 2,827028575 |

**Penyusunan Atribut**

Berdasarkan tabel 4.42 selanjutnya atribut disusun secara *descending* (*high to low*) berdasarkan nilai tertinggi ke terendah seperti pada tabel 4.43 berikut.

Tabel 4.63 Ranking Seleksi Fitur

|  |  |  |
| --- | --- | --- |
| **No** | **Atribut** | **Gain Ratio** |
| 1 | nilai\_si | 0,047141341 |
| 2 | nilai\_metnum | 0,038364846 |
| 3 | nilai\_basdat | 0,034808187 |
| 4 | nilai\_rpl | 0,034084803 |
| 5 | nilai\_ki | 0,033235962 |
| 6 | nilai\_pb | 0,031455653 |
| 7 | nilai\_matdis | 0,030078838 |
| 8 | nilai\_daspro | 0,02680013 |
| 9 | nilai\_so | 0,026638617 |
| 10 | nilai\_sisdig | 0,026179857 |
| 11 | nilai\_sbd | 0,024667063 |
| 12 | nilai\_arkom | 0,023583904 |
| 13 | nilai\_alpro | 0,015598817 |
| 14 | nilai\_jarkom | 0,014894488 |
| 15 | nilai\_strukdat | 0,013292549 |

**Pemilihan Atribut**

Selanjutnya akan di ambil atribut top *ranking* yang dibutuhkan sebanyak 4 atribut tertinggi seperti pada tabel 4.113. Berdasarkan 4 atribut tertinggi dapat berpengaruh pada hasil prediksi kelulusan mahasiswa, sehingga dapat meningkatkan akurasi hasil prediksi.

Tabel 4.64 Atribut yang dipilih

|  |  |  |
| --- | --- | --- |
| **No** | **Atribut** | **Gain Ratio** |
| 1 | nilai\_si | 0,047141341 |
| 2 | nilai\_metnum | 0,038364846 |
| 3 | nilai\_basdat | 0,034808187 |
| 4 | nilai\_rpl | 0,034084803 |

### Pembagian Data

Data yang telah melewati proses *pre-processing* akan melakukan proses pembagian data, pembagian data merupakan mengubah data set menjadi data *training* dan data *testing* dengan metorde *split validation*. Dataset yang digunakan yaitu dataset yang telah ditransformasi pada tabel 4.3 yang berjumlah 536 data mahasiswa. Atribut yang akan digunakan pada proses pembagian ini adalah hasil dengan bobot terbaik menurut perhitungan menggunakan algoritma information gain ratio.

Pembagian data *training* dan data *testing* dilakukan pada masing-masing rasio perbandingan. Sehingga masing-masing perbandingan rasio memiliki akurasi dari pembagian data. Setelah didapat akurasi dari model terbaik yang telah di evaluasi, selanjutnya akan dilakukan proses *data mining* untuk memprediksi data baru mahasiswa dan mengetahui hasil prediksi pada algoritma *Naïve Bayes* berbasis *Information Gain Ratio.*

Tabel 4.65 Data Training

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No | Sistem Informasi | Metode Numerik | … | Pemrograman Bergerak | Matematika Diskrit | Status Kelulusan |
| 1 | 3.0 | 2.0 | … | 0 | 2.4 | |  | | --- | | TERLAMBAT | |
| 2 | 2.4 | 2.0 | … | 2.0 | 2.7 | TERLAMBAT |
| 3 | 3.0 | 2.0 | … | 0 | 3.4 | TERLAMBAT |
| 4 | 1.0 | 2.7 | … | 2.0 | 2.0 | TERLAMBAT |
| 5 | 3.0 | 2.7 | … | 4.0 | 2.4 | TERLAMBAT |
| 6 | 3.7 | 3.4 | … | 3.7 | 3.7 | TERLAMBAT |
| 7 | 3.7 | 3.4 | … | 2.7 | 2.7 | TERLAMBAT |
| 8 | 2.4 | 3.7 | … | 3.7 | 3.0 | TERLAMBAT |
| 9 | 3.4 | 3.0 | … | 4.0 | 2.7 | TERLAMBAT |
| … | … | … | … | … | … | … |
| 482 | 3.0 | 2.0 | … | 3.4 | 3.0 | TERLAMBAT |

Tabel 4.66 Data Testing

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No | Sistem Informasi | Metode Numerik | … | Pemrograman Bergerak | Matematika Diskrit | Status Kelulusan |
| 1 | 3.0 | 3.7 | … | 3.7 | 3.0 | SEDANG |
| 2 | 3.7 | 4.0 | … | 2.7 | 4.0 | TERLAMBAT |
| 3 | 3.4 | 3.7 | … | 3.0 | 3.7 | TERLAMBAT |
| 4 | 3.7 | 2.7 | … | 1.0 | 3.4 | TERLAMBAT |
| 5 | 3.4 | 2.0 | … | 4.0 | 2.7 | TERLAMBAT |
| 6 | 2.7 | 4.0 | … | 4.0 | 2.7 | TERLAMBAT |
| 7 | 3.4 | 3.0 | … | 3.4 | 3.0 | SEDANG |
| 8 | 4.0 | 3.4 | … | 3.0 | 3.7 | SEDANG |
| 9 | 3.7 | 4.0 | … | 3.4 | 3.4 | SEDANG |
| … | … | … | … | … | … | … |
| 54 | 4.0 | 4.0 | … | 3.4 | 3.7 | SEDANG |

### *Naïve Bayes*

Proses data mining dilakukan dengan menggunakan perhitungan Distribusi Gaussian / Densitas Gauss pada rumus (2.4). Berikut ini perhitungan distribusi gaussian pada algoritma naïve bayes dengan feature selection information gain.

**Input *datasets***

Tahap pertama, menginput dataset mahasiswa dengan data yang sudah dilakukan pembagian data pada tabel 4.65 dan atribut terbaik menurut perhitungan information gain pada tabel 4.64.

**Pengecekan Data**

Setelah penginputan data, data akan dicek untuk menghitung jumlah data probabilitas pada masing-masing data.

Mencari nilai mean dan standar deviasi dari setiap parameter

Persamaan yang digunakan untuk menghitung rata-rata (*mean*) ada pada rumus (2.7) dengan dataset yang digunakan pada tabel (4.65). berikut perhitungannya :

* si
* metnum
* basdat
* rpl

Tabel 4.67 Nilai Mean (Rata-rata) *Feature*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **MEAN** | | | | |
| **No** | **Atribut** | **Tepat** | **Sedang** | **Terlambat** |
| 1 | Nilai\_si |  |  |  |
| 2 | Nilai\_metnum |  |  |  |
| 3 | Nilai\_basdat |  |  |  |
| 4 | Nilai\_rpl |  |  |  |

Dan persamaan untuk menghitung nilai simpangan baku (standar deviasi) pada rumus (2.8). Data perhitungan standar deviasi diperoleh dari tabel 4.65 dan tabel 4.67 sebagai berikut.

* Ips 1
* Ips 6
* Tempat Lahir
* Ips 2

Tabel 4.52 Nilai Standar Deviasi *Feature*

|  |  |  |  |
| --- | --- | --- | --- |
| **STANDAR DEVIASI** | | | |
| **No** | **Atribut** | **Tepat Waktu** | **Tidak Tepat Waktu** |
| 1 | Ip Semester 1 | 0.17475833911591215 | 0.21592890588876182 |
| 2 | Ip Semester 6 | 0.08022925404681795 | 0.1807624350961126 |
| 3 | Tempat Lahir | 0.21774840516308375 | 0.2625487903639705 |
| 4 | Ip Semester 2 | 0.08902104183062357 | 0.1460686558508312 |

Cari nilai probabilitas kelas dengan cara menghitung jumlah data yang sesuai dari kategori yang sama dibagi dengan jumlah data pada semua kategori. Data perhitungan probabilitas diperoleh dari tabel 4.50. Berikut perhitungan nilai probabilitas kelas.

**Perhitungan Data Prediksi**

Hitung data prediksi sesuai atribut terpilih sebelumnya dengan cara menghitung probabilitas distribusi gaussian pada rumus (2.4) berdasarkan nilai dalam tabel mean, standard deviasi dan probabilitas dari masing-masing atribut, sehingga diperoleh nilai probabilitas distribusi gaussian pada atribut sesuai kelas kemudian kalikan semua nilai probabilitas yang telah dihitung pada atribut berdasarkan kelasnya. Data perhitungan distribusi gaussian diperoleh dari tabel 4.48, tabel 4.51 dan tabel 4.52. Berikut perhitungan data prediksi.

* Ip Semester 1

**..........**

**..........**

Perhitungan yang sama dilakukan pada atribut lain yang terpilih pada tahap seleksi fitur yaitu ip semester 6, tempat lahir dan ip semester 2, sehingga diperoleh hasil perhitungan prediksi sebagai berikut.

Tabel 4.53 Hasil Perhitungan Prediksi *Feature*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DATA PREDIKSI** | | | | | |
| **No** | **Nim** | **...** | **Gaussian Tepat Waktu** | **Gaussian Tidak Tepat Waktu** | **Hasil Prediksi** |
| 1 | 11551100281 | ... | 0.000000000021397488117522993 | 0.08472922370177127 | Tidak Tepat Waktu |
| 2 | 11551100255 | ... | 0.0000007957944252828238 | 0.9821151829699172 | Tidak Tepat Waktu |
| 3 | 11551100287 | ... | 0.0000001808441670377982 | 1.603176869581568 | Tidak Tepat Waktu |
| 4 | 11551100290 | ... | 0.02122082830230125 | 0.3608865587382811 | Tidak Tepat Waktu |
| 5 | 11551100310 | ... | 0.03594398130657293 | 14.710698111963662 | Tidak Tepat Waktu |
| ... | ... | ... | ... | ... | ... |
| 360 | 11651203659 | ... | 0.0048731396750401985 | 9.007064773376502 | Tidak Tepat Waktu |

**Penentuan Kelas**

Penentuan kelas ditentukan berdasarkan nilai akhir dari distribusi gaussian yang terbesar dari masing-masing kelas. Nilai akhir distribusi gaussian diperoleh dengan mengalikan seluruh nilai dsitribusi gaussian dari masing-masing atribut terpilih pada masing-masing kelas. Berikut data hasil prediksi.

Tabel 4.54 Hasil Prediksi *Feature*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DATA TESTING** | | | | | | |
| **No** | **Nim** | **Ip Semester 1** | **Ip Semester 6** | **Tempat Lahir** | **Ip Semester 2** | **Hasil Prediksi** |
| 1 | 11551100281 | 1.82 | 2.54 | pauh angit | 2.33 | Tidak Tepat Waktu |
| 2 | 11551100255 | 1.95 | 2.58 | Babussalam | 2.95 | Tidak Tepat Waktu |
| 3 | 11551100287 | 3.23 | 2.26 | Babussalam | 2.85 | Tidak Tepat Waktu |
| 4 | 11551100290 | 3.49 | 2.86 | Aceh | 3.66 | Tidak Tepat Waktu |
| 5 | 11551100310 | 2.87 | 2.91 | Medan | 2.93 | Tidak Tepat Waktu |
| ... | ... | ... | ... | ... |  | ... |
| 360 | 11651203659 | 3.08 | 2.95 | Pekanbaru | 2.68 | Tidak Tepat Waktu |

Berdasarkan perhitungan pada algoritma *naïve bayes* berbasis *feature selection information gain* yang telah dilakukan yang terdiri dari data prediksi mahasiswa yang berjumlah 360 diperoleh jumlah mahasiswa yang telah berhasil diprediksi tepat waktu sebanyak 41 orang dan diprediksi tidak tepat waktu sebanyak 319 orang.