* **Web Scraping**

**Apa Itu Web Scraping?**

Web scraping adalah metode yang sangat berguna dalam bisnis online, baik itu untuk riset pasar, riset kompetitor, atau mencari leads. Namun, manfaatnya lebih dari sekedar itu.

Dalam menjalankan bisnis online, pastinya Anda pernah mendata kompetitor-kompetitor Anda beserta informasi penting mengenai produk atau layanan mereka.

Kemudian, Anda menyimpan data tersebut di dalam sebuah spreadsheet — baik itu menggunakan Microsoft Excel, Google Sheet atau aplikasi sejenisnya. Proses inilah yang disebut sebagai web scraping.

Dengan kata lain, web scraping dapat didefinisikan sebagai proses pengambilan data dari sebuah website.

Secara umum, ada dua cara yang bisa Anda gunakan untuk melakukannya :

* **Manual** — metode di mana Anda menyalin data dengan cara copy paste dari sebuah website
* **Otomatis** — metode yang menggunakan koding, aplikasi, atau extension browser.

## Teknik-Teknik Web Scraping

Web scraping kini dimudahkan dengan bantuan browser extension dan aplikasi. Namun, hasilnya masih belum sebaik cara manual dan koding. Dalam artikel ini  kami akan membahas enam teknik web scraping yang umum dilakukan, yaitu:

* Menyalin data secara manual
* Menggunakan regular expression
* Parsing HTML
* Menganalisa DOM
* Menggunakan XPath
* Menggunakan Google Sheet

### 1. Menyalin Data secara Manual

Cara web scraping yang paling sederhana adalah menyalin data website secara manual. Karena Anda harus mengambil dan menyimpan informasi yang diperlukan satu per satu, teknik ini memakan waktu lama.

Akan tetapi, metode ini paling efektif dari segi pencarian data. Tidak seperti tool atau bot, Anda sudah tahu letak informasi yang ingin disalin dari suatu website. Dengan demikian, hasil web scraping dengan cara ini sangat akurat.

Teknik manual ini dianjurkan jika jumlah website atau blog yang ingin Anda saring terbatas.

### 2. Menggunakan Regular Expression

Regular expression adalah baris kode yang digunakan dalam algoritma pencarian untuk menemukan tipe data tertentu dari sebuah file. Dalam konteks web scraping, file yang dimaksud adalah file-file penunjang sebuah website.

Keuntungan utama menggunakan regular expression untuk web scraping adalah konsistensi syntaxnya di dalam berbagai [bahasa pemrograman](https://www.niagahoster.co.id/blog/bahasa-pemrograman/). Oleh karena itu, teknik ini sangat fleksibel.

Ditambah lagi, regular expression dapat digunakan untuk mencari data berdasarkan jenisnya, seperti nama produk, harga, dan alamat email.

### 3. Parsing HTML

Pada dasarnya, parsing HTML adalah metode yang dilakukan dengan mengirimkan HTTP request kepada server yang menyimpan data website yang datanya ingin Anda ekstrak.

Dengan teknik ini, Anda dapat melakukan web scraping tidak hanya pada halaman website yang bersifat statis, tetapi juga dinamis. Selain itu, parsing HTML juga memungkinkan Anda untuk menyalin data dalam jumlah yang besar dalam waktu singkat.

Sayangnya, parsing HTML dapat dicegah dengan proteksi website. Tak hanya itu, Anda bisa diblokir dari suatu situs jika terlalu sering melakukan teknik ini.

### 4. Menganalisa DOM

DOM atau document object model adalah representasi struktur sebuah halaman website yang ditulis dengan HTML.

Ketika melakukan parsing HTML, DOM dari halaman yang ingin diekstrak datanya akan dimuat terlebih dahulu. Untungnya, DOM juga membawa data yang ada pada file HTML.

Oleh karena itu, analisa DOM bisa dijadikan alternatif untuk melakukan web scraping terhadap halaman situs dinamis jika parsing HTML tidak membuahkan hasil.

Untuk membantu proses ini, Anda bisa mencari informasi yang diinginkan dengan regular expression (poin nomor 2).

### 5. Menggunakan XPath

XPath adalah bahasa query yang digunakan untuk memilih node dari struktur file XML dan HTML.

Implementasinya tidak jauh berbeda dengan analisa DOM. Anda menggunakannya untuk mencari data dari struktur file penunjang halaman.

Selain itu, XPath juga dapat digunakan untuk mencari data pada elemen teks dalam file XML dan HTML. Dengan demikian, teknik web scraping ini bisa Anda pilih ketika analisa DOM kurang efektif.

6. Menggunakan Google Sheet

Google Sheet adalah aplikasi web milik Google yang biasanya digunakan untuk membuat spreadsheet. Akan tetapi, aplikasi ini ternyata juga bisa digunakan untuk melakukan web scraping dengan mudah.

Di samping Google Sheet, Anda hanya memerlukan browser yang memiliki fitur inspect element. Setelah itu, tinggal mengopi expression XPath dari elemen halaman website yang datanya ingin Anda salin ke dalam command IMPORTXML yang ada di Google Sheet.

## Manfaat Web Scraping

Seperti yang telah disebutkan di awal artikel, penggunaan web scraping menawarkan beberapa manfaat. Berikut ini adalah empat keuntungan utamanya.

## Mendapatkan Leads

Dalam berburu leads untuk bisnis baru, tidak ada salahnya jika Anda mendekati follower akun media sosial kompetitor. Bahkan, kemungkinan mereka berkemungkinan besar untuk tertarik dengan produk atau layanan Anda.

Nah, web scraping dilakukan untuk memudahkan proses ini. Dengannya, Anda bisa menyalin daftar follower masing-masing kompetitor dan mengopi alamat email mereka. Tak lupa, Anda dapat menggunakan data lain seperti demografi follower untuk jadi bahan segmentasi.

## Membandingkan Ulasan dalam Jumlah Besar

Memiliki pemahaman yang mendalam atas kebutuhan konsumen adalah sebuah kewajiban jika Anda ingin memenangkan hati mereka. Dengan mengantongi pengetahuan tersebut, Anda dapat meningkatkan layanan atau menciptakan produk yang solutif.

Untuk dapat melakukannya, Anda bisa membaca ulasan-ulasan konsumen tentang produk dan layanan kompetitor, baik itu di blog review, forum, maupun marketplace online.

Dengan adanya web scraping, usaha Anda untuk mendokumentasikan data tersebut akan dipermudah dan dipercepat.

## Optimasi Harga Produk atau Layanan

Menentukan harga bagi layanan atau produk Anda memang tidak mudah. Ada banyak hal yang perlu diperhatikan, termasuk biaya produksi, SDM, brand positioning, dan harga yang ditawarkan kompetitor.

Setidaknya, web scraping membantu Anda untuk mengumpulkan harga produk dan layanan bisnis pesaing. Dengan demikian, Anda dapat memperhatikan tren harga yang ada di pasar.

## Mencari Informasi sebuah Perusahaan

Suatu saat mungkin Anda perlu bekerjasama dengan pemilik bisnis lain. Namun, Anda ingin memastikan bahwa usaha tersebut dapat dipercaya.

Nah, Anda bisa melakukan “investigasi” mandiri terhadap usaha tersebut di internet dengan bantuan web scraping.

## Kendala dalam Melakukan Web Scraping

Meskipun web scraping merupakan teknik yang sangat membantu dalam ekstraksi data situs, ada juga hal-hal yang menjadi halangan dalam implementasinya. Setidaknya, lima hal di bawah ini perlu Anda ingat jika ingin melakukannya:

* **Tidak ada teknik web scraping yang 100% efektif** — Metode web scraping, baik yang dibahas dalam artikel ini maupun yang menggunakan aplikasi, tidak ada yang sempurna.
* **Data yang didapat tidak selalu rapi** — Apapun metode yang Anda pakai pasti akan menyisakan teks-teks yang tidak diinginkan, seperti tag HTML. Oleh karenanya, Anda masih harus merapikan data hasil web scraping.
* **Pemahaman tentang struktur halaman website tetap menjadi kewajiban** — Tidak semua teknik web scraping memerlukan koding. Akan tetapi, Anda tetap harus memahami HTML dan CSS. Ini dibutuhkan ketika Anda mencari letak data yang ingin diekstrak menggunakan fitur inspect element pada browser.
* **Akses Anda ke suatu website dapat diblokir** — terlalu sering melakukan web scraping terhadap suatu website dapat menyebabkan [IP](https://www.niagahoster.co.id/blog/ip-address-adalah/) Anda diblokir oleh adminnya.
* **Tidak semua website mudah diekstrak datanya** — [Web developer](https://www.niagahoster.co.id/blog/web-developer/) akan selalu memperbarui websitenya, baik dari segi kode maupun struktur halamannya, untuk alasan keamanan. Maka dari itu, jangan heran ketika Anda menemui situs yang datanya susah diekstrak.
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**" \* @author Imam Kusuma <ikusuma@kemana.com>\n",**

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**" \* @author Imam Kusuma <ikusuma@kemana.com>\n",**

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**" \* @author Imam Kusuma <ikusuma@kemana.com>\n",**

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**"<a class=\"product photo product-item-photo\" href=\"https://eraspace.com/erafone/apple-iphone-xr-256gb\" tabindex=\"-1\">\n",**

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**" \* @author Imam Kusuma <ikusuma@kemana.com>\n",**

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**" harga = p.find('span','price').get\_text()\n",**

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**" soup = BeautifulSoup(response.content, 'html.parser')\n",**

**" produk = soup.find\_all('li', 'item product product-item')\n",**

**" try:\n",**

**" for x in produk:\n",**

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**" harga = x.find('span','price').get\_text().replace('Rp', '').replace('.','')\n",**

**" nama\_produk.append(nama)\n",**

**" harga\_produk.append(harga)\n",**

**" except:\n",**

**" continue\n",**

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**"df = pd.DataFrame(produk\_dict, columns=['nama','harga'])\n",**

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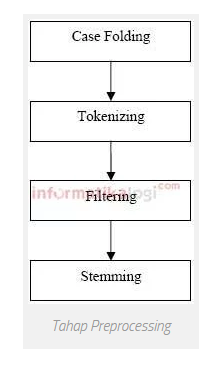
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# **Text Preprocessing**

Berdasarkan ketidak teraturan struktur data teks, maka proses [sistem temu kembali informasi](https://informatikalogi.com/sistem-temu-kembali-informasi/) ataupun text mining memerlukan beberapa tahap awal yang pada intinya adalah mempersiapkan agar teks dapat diubah menjadi lebih terstruktur. Salah satu implementasi dari text mining adalah tahap **Text Preprocessing**.

Tahap **Text Preprocessing** adalah tahapan dimana aplikasi melakukan seleksi data yang akan diproses pada setiap dokumen. Proses preprocessing ini meliputi **(1) case folding**, **(2) tokenizing**, **(3) filtering**, dan **(4) stemming**

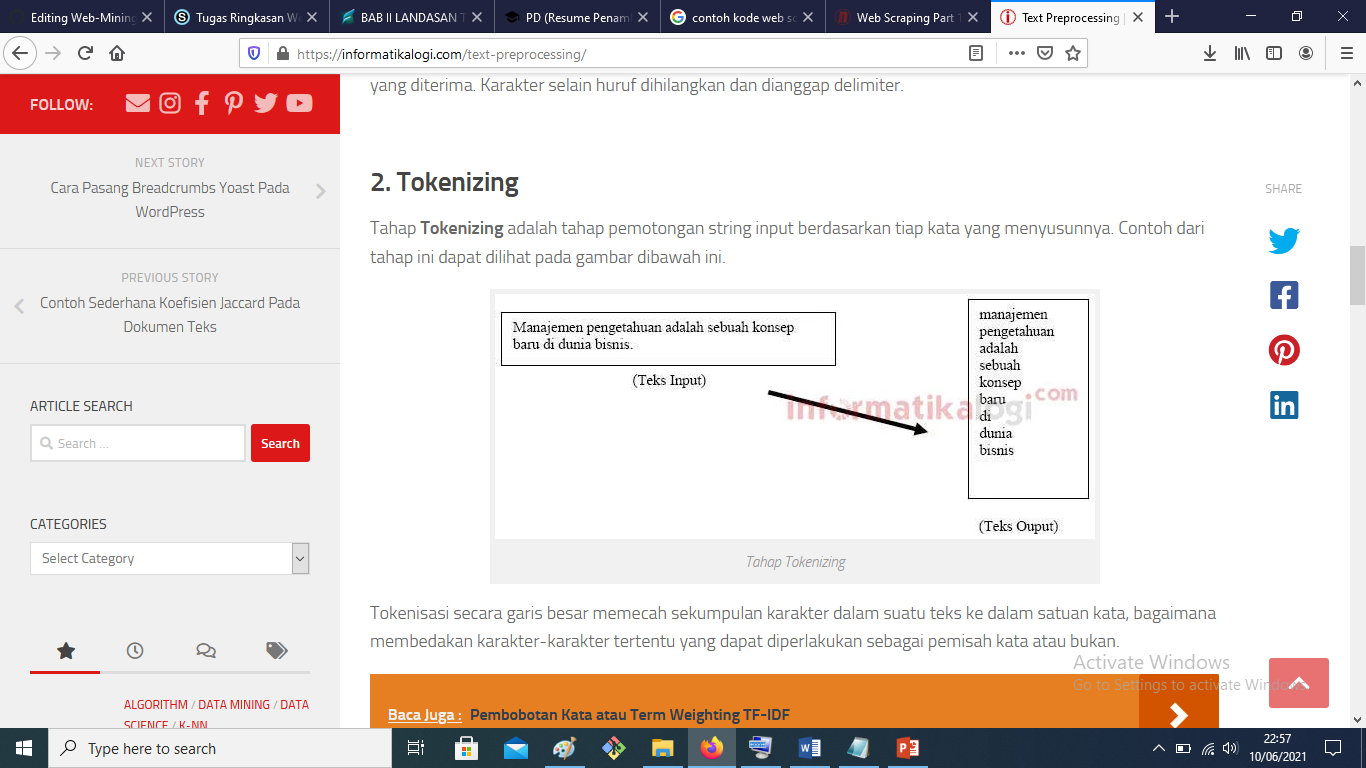
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## ****1. Case Folding****

Tidak semua dokumen teks konsisten dalam penggunaan huruf kapital. Oleh karena itu, peran **Case Folding** dibutuhkan dalam mengkonversi keseluruhan teks dalam dokumen menjadi suatu bentuk standar (biasanya huruf kecil atau lowercase). Sebagai contoh, user yang ingin mendapatkan informasi “**KOMPUTER**” dan mengetik “**KOMPOTER**”, “**KomPUter**”, atau “**komputer**”, tetap diberikan hasil retrieval yang sama yakni “**komputer**”. Case folding adalah mengubah semua huruf dalam dokumen menjadi huruf kecil. Hanya huruf ‘a’ sampai dengan ‘z’ yang diterima. Karakter selain huruf dihilangkan dan dianggap delimiter.

## ****2. Tokenizing****

Tahap **Tokenizing** adalah tahap pemotongan string input berdasarkan tiap kata yang menyusunnya. Contoh dari tahap ini dapat dilihat pada gambar dibawah ini.



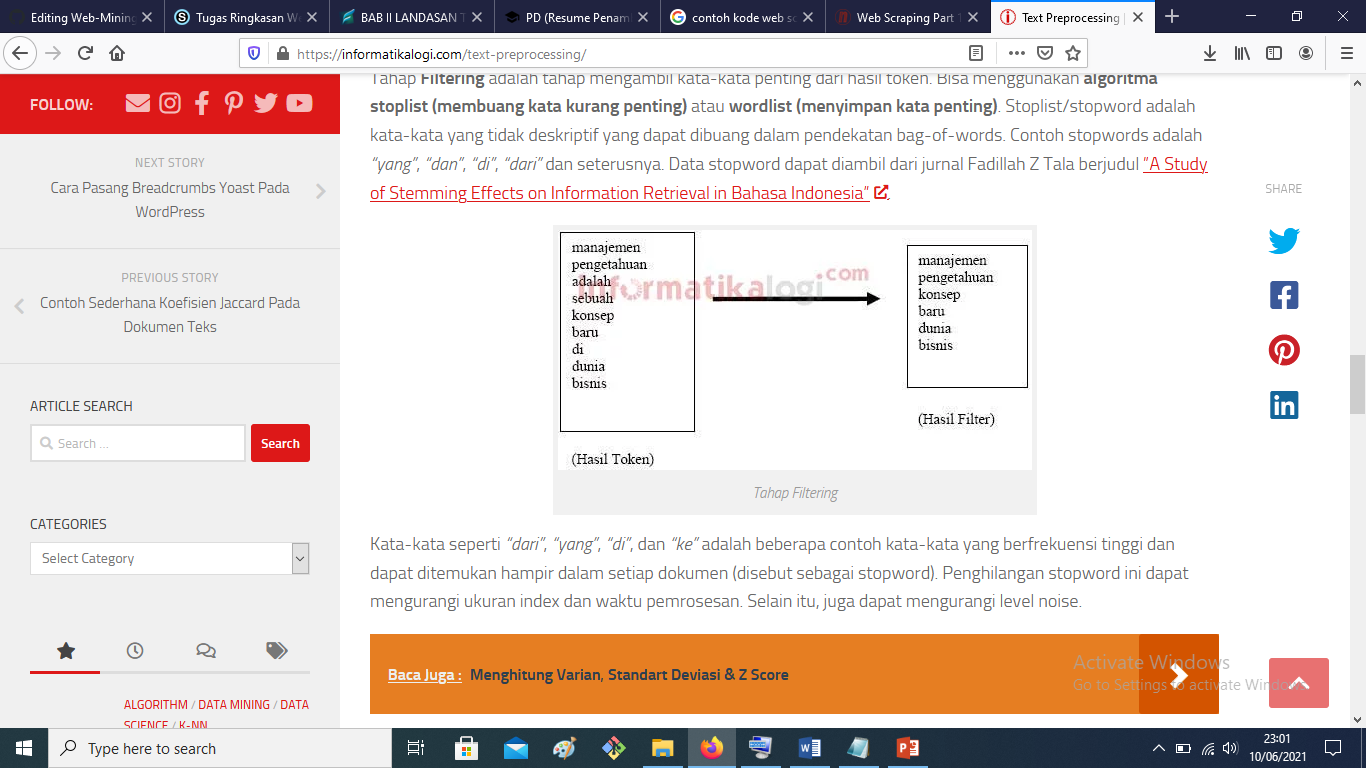
Tokenisasi secara garis besar memecah sekumpulan karakter dalam suatu teks ke dalam satuan kata, bagaimana membedakan karakter-karakter tertentu yang dapat diperlakukan sebagai pemisah kata atau bukan.

Sebagai contoh karakter whitespace, seperti enter, tabulasi, spasi dianggap sebagai pemisah kata. Namun untuk karakter petik tunggal **(‘)**, titik **(.)**, semikolon **(;)**, titk dua **(:)** atau lainnya, dapat memiliki peran yang cukup banyak sebagai pemisah kata.

 Dalam memperlakukan karakter-karakter dalam teks sangat tergantung pada kontek aplikasi yang dikembangkan. Pekerjaan tokenisasi ini akan semakin sulit jika juga harus memperhatikan struktur bahasa (grammatikal).

**3. Filtering**

Tahap **Filtering** adalah tahap mengambil kata-kata penting dari hasil token. Bisa menggunakan **algoritma stoplist (membuang kata kurang penting)** atau **wordlist (menyimpan kata penting)**. Stoplist/stopword adalah kata-kata yang tidak deskriptif yang dapat dibuang dalam pendekatan bag-of-words. Contoh stopwords adalah “yang”, “dan”, “di”, “dari” dan seterusnya. Data stopword dapat diambil dari jurnal Fadillah Z Tala berjudul [”A Study of Stemming Effects on Information Retrieval in Bahasa Indonesia”](http://dare.uva.nl/cgi/arno/show.cgi?fid=443347).



Kata-kata seperti “dari”, “yang”, “di”, dan “ke” adalah beberapa contoh kata-kata yang berfrekuensi tinggi dan dapat ditemukan hampir dalam setiap dokumen (disebut sebagai stopword). Penghilangan stopword ini dapat mengurangi ukuran index dan waktu pemrosesan. Selain itu, juga dapat mengurangi level noise.

Namun terkadang stopping tidak selalu meningkatkan nilai retrieval. Pembangunan daftar stopword (disebut stoplist) yang kurang hati-hati dapat memperburuk kinerja sistem **Information Retrieval (IR)**. Belum ada suatu kesimpulan pasti bahwa penggunaan stopping akan selalu meningkatkan nilai retrieval, karena pada beberapa penelitian, hasil yang didapatkan cenderung bervariasi.

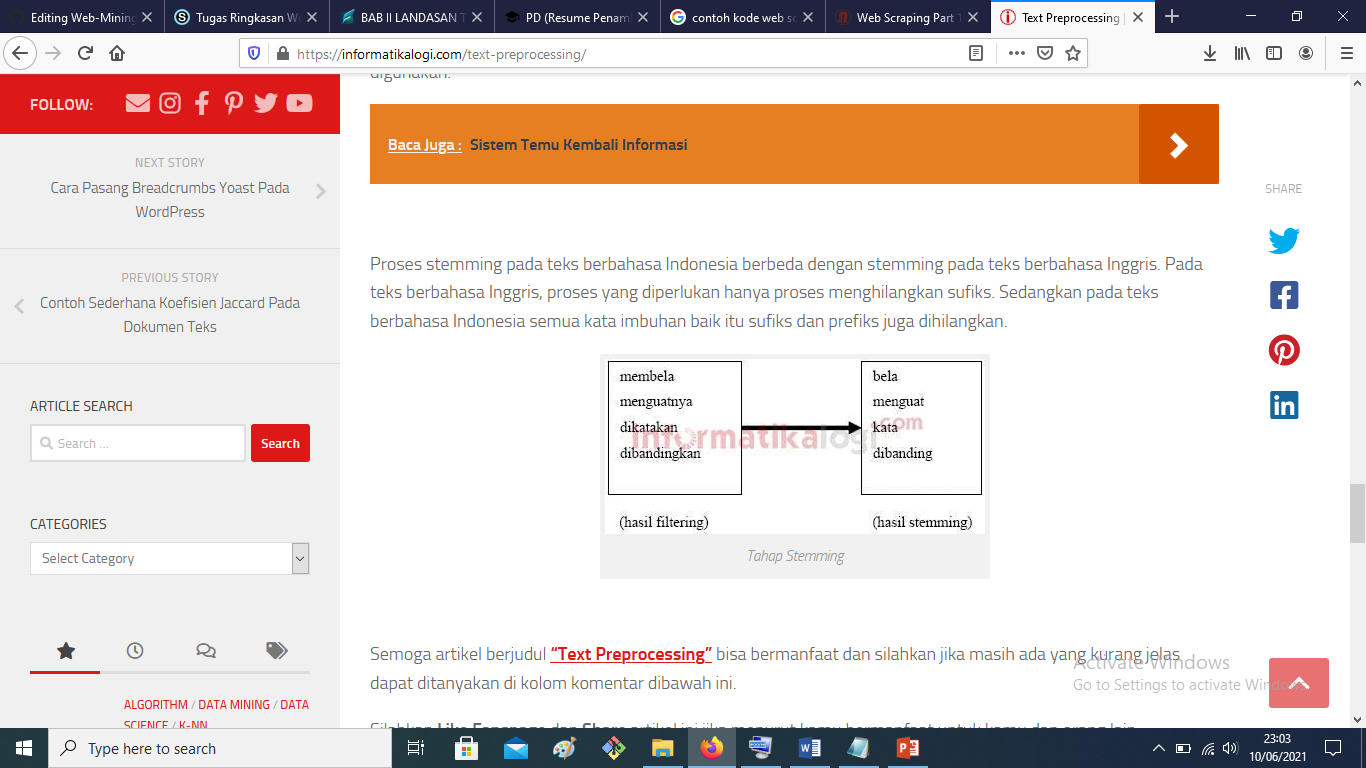
**4. Stemming**

Pembuatan indeks dilakukan karena suatu dokumen tidak dapat dikenali langsung oleh suatu [**Sistem Temu Kembali Informasi**](https://informatikalogi.com/sistem-temu-kembali-informasi/) atau I**nformation Retrieval System (IRS)**. Oleh karena itu, dokumen tersebut terlebih dahulu perlu dipetakan ke dalam suatu representasi dengan menggunakan teks yang berada di dalamnya.

 Teknik **Stemming** diperlukan selain untuk memperkecil jumlah indeks yang berbeda dari suatu dokumen, juga untuk melakukan pengelompokan kata-kata lain yang memiliki kata dasar dan arti yang serupa namun memiliki bentuk atau form yang berbeda karena mendapatkan imbuhan yang berbeda.

 Sebagai contoh kata bersama, kebersamaan, menyamai, akan distem ke root word-nya yaitu “sama”. Namun, seperti halnya stopping, kinerja stemming juga bervariasi dan sering tergantung pada domain bahasa yang digunakan.

Proses stemming pada teks berbahasa Indonesia berbeda dengan stemming pada teks berbahasa Inggris. Pada teks berbahasa Inggris, proses yang diperlukan hanya proses menghilangkan sufiks. Sedangkan pada teks berbahasa Indonesia semua kata imbuhan baik itu sufiks dan prefiks juga dihilangkan.



* **Code**

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"import string\n",

"\n",

"kalimat = \"Ini &adalah [contoh] kalimat? {dengan} tanda. baca?!!\"\n",

"hasil = kalimat.translate(str.maketrans(\"\",\"\",string.punctuation))\n",

"print(hasil)"

]

},

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"## Case Folding: Removing Whitespace ##\n",

"Menghapus karakter kosong."

]

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"kalimat = \" \\t ini kalimat contoh\\t \"\n",

"hasil = kalimat.strip()\n",

"print(hasil)"

]

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"## Separating Sentences with Split () Method ##\n",

"Fungsi `split()` memisahkan \_string\_ ke dalam \_list\_ dengan spasi sebagai pemisah jika tidak ditentukan pemisahnya.\n",

"\n",

"https://www.w3schools.com/python/ref\_string\_split.asp"

]

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"kalimat = \"rumah idaman adalah rumah yang bersih\"\n",

"pisah = kalimat.split()\n",

"print(pisah)"

]

},

{

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"## Tokenizing: Word Tokenizing Using NLTK Module ##\n",

"Menggunakan \_library\_ NLTK untuk memisahkan kata dalam sebuah kalimat. \n"

]

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"from nltk.tokenize import word\_tokenize \n",

" \n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online.\"\n",

"\n",

"tokens = nltk.tokenize.word\_tokenize(kalimat)\n",

"print(tokens)"

]

},

{

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"## Tokenizing with Case Folding ##\n",

"Menggabungkan teknik \_Case Foling\_ dengan \_Tokenizing\_."

]

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"from nltk.tokenize import word\_tokenize \n",

" \n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online.\"\n",

"kalimat = kalimat.translate(str.maketrans('','',string.punctuation)).lower()\n",

" \n",

"tokens = nltk.tokenize.word\_tokenize(kalimat)\n",

"print(tokens)"

]

},

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"## Frequency Distribution ##\n",

"Menghitung frekuensi kemunculan setiap tokens(kata) dalam teks."

]

},

{

"cell\_type": "code",

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"from nltk.tokenize import word\_tokenize\n",

"from nltk.probability import FreqDist\n",

"\n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online. Menurut Andi belanja online lebih praktis & murah.\"\n",

"kalimat = kalimat.translate(str.maketrans('','',string.punctuation)).lower()\n",

" \n",

"tokens = nltk.tokenize.word\_tokenize(kalimat)\n",

"kemunculan = nltk.FreqDist(tokens)\n",

"print(kemunculan.most\_common())"

]

},

{

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"## Frequency Distribution Visualization with Matplotlib ##\n",

"Untuk menggambarkan frekuensi kemunculan setiap tokens dapat menggunakan \_library\_ \_\_matplotlib\_\_ pada Python.\n",

"\n",

"https://matplotlib.org"

]

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"import matplotlib.pyplot as plt\n",

"\n",

"kemunculan.plot(30,cumulative=False)\n",

"plt.show()"

]

},

{

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"## Tokenizing: Sentences Tokenizing Using NLTK Module ##\n",

"Memisahkan kalimat dalam sebuah paragraf."

]

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"from nltk.tokenize import sent\_tokenize\n",

"\n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online. Menurut Andi belanja online lebih praktis & murah.\"\n",

" \n",

"tokens = nltk.tokenize.sent\_tokenize(kalimat)\n",

"print(tokens)"

]

},

{

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"## Filtering using NLTK ##"

]

},

{

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"from nltk.tokenize import sent\_tokenize, word\_tokenize\n",

"from nltk.corpus import stopwords\n",

" \n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online. Menurut Andi belanja online lebih praktis & murah.\"\n",

"kalimat = kalimat.translate(str.maketrans('','',string.punctuation)).lower()\n",

" \n",

"tokens = word\_tokenize(kalimat)\n",

"listStopword = set(stopwords.words('indonesian'))\n",

" \n",

"removed = []\n",

"for t in tokens:\n",

" if t not in listStopword:\n",

" removed.append(t)\n",

" \n",

"print(removed)"

]

},

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"## Filtering using Sastrawi: Stopword List ##\n",

"Melihat daftar \_stopword\_ pada Sastrawi."

]

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"from Sastrawi.StopWordRemover.StopWordRemoverFactory import StopWordRemoverFactory\n",

" \n",

"factory = StopWordRemoverFactory()\n",

"stopwords = factory.get\_stop\_words()\n",

"print(stopwords)"

]

},

{

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"## Filtering using Sastrawi ##"

]

},

{

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"from Sastrawi.StopWordRemover.StopWordRemoverFactory import StopWordRemoverFactory\n",

"from nltk.tokenize import word\_tokenize \n",

"\n",

"factory = StopWordRemoverFactory()\n",

"stopword = factory.create\_stop\_word\_remover()\n",

"\n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online. Menurut Andi belanja online lebih praktis & murah.\"\n",

"kalimat = kalimat.translate(str.maketrans('','',string.punctuation)).lower()\n",

"\n",

"stop = stopword.remove(kalimat)\n",

"tokens = nltk.tokenize.word\_tokenize(stop)\n",

"\n",

"print(tokens)"

]

},

{

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"## Add Custom Stopword ##\n",

"Menambahkan kata di \_stopword\_ untuk dihilangkan pada sebuah teks."

]

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"from Sastrawi.StopWordRemover.StopWordRemoverFactory import StopWordRemoverFactory, StopWordRemover, ArrayDictionary\n",

"from nltk.tokenize import word\_tokenize \n",

" \n",

"# ambil stopword bawaan\n",

"stop\_factory = StopWordRemoverFactory().get\_stop\_words()\n",

"more\_stopword = ['daring', 'online']\n",

"\n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online. Menurut Andi belanja online lebih praktis & murah.\"\n",

"kalimat = kalimat.translate(str.maketrans('','',string.punctuation)).lower()\n",

"\n",

"# menggabungkan stopword\n",

"data = stop\_factory + more\_stopword\n",

" \n",

"dictionary = ArrayDictionary(data)\n",

"str = StopWordRemover(dictionary)\n",

"tokens = nltk.tokenize.word\_tokenize(str.remove(kalimat))\n",

" \n",

"print(tokens)"

]

},

{

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"## Stemming : Porter Stemming Algorithm using NLTK ##\n",

"\n",

"https://tartarus.org/martin/PorterStemmer/index-old.html"

]

},

{

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"source": [

"from nltk.stem import PorterStemmer \n",

"ps = PorterStemmer() \n",

"\n",

"kata = [\"program\", \"programs\", \"programer\", \"programing\", \"programers\"] \n",

" \n",

"for k in kata: \n",

" print(k, \" : \", ps.stem(k))"

]

},

{

"cell\_type": "markdown",

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"## Stemming Bahasa Indonesia using Sastrawi ##"

]

},

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"from Sastrawi.Stemmer.StemmerFactory import StemmerFactory\n",

"factory = StemmerFactory()\n",

"stemmer = factory.create\_stemmer()\n",

" \n",

"kalimat = \"Andi kerap melakukan transaksi rutin secara daring atau online. Menurut Andi belanja online lebih praktis & murah.\"\n",

"\n",

"hasil = stemmer.stem(kalimat)\n",

"print(hasil)"

]

},

{

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"Ditulis oleh: \_\_Kuncahyo Setyo Nugroho\_\_ pada Artikel: https://medium.com/@ksnugroho/dasar-text-preprocessing-dengan-python-a4fa52608ffe"

]

}

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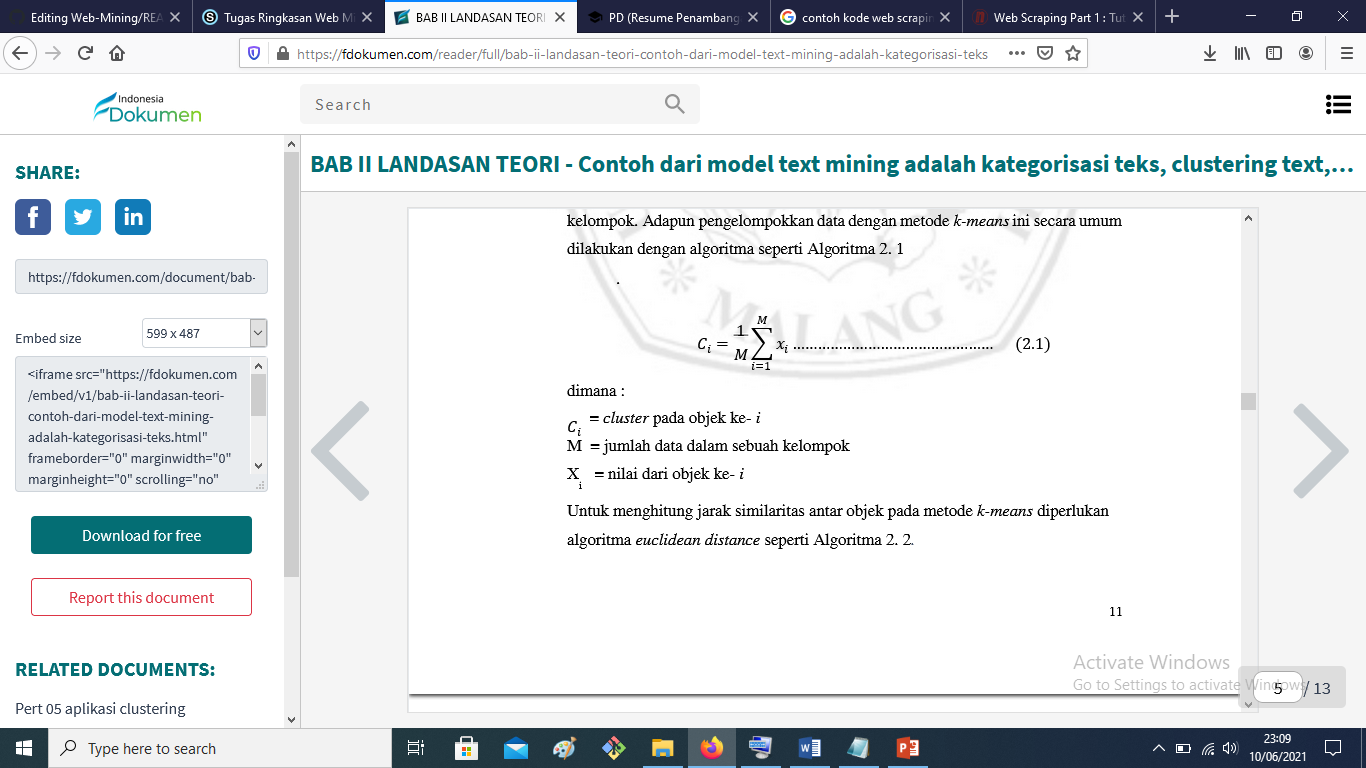
* **Klasterisasi**

Konsep dari pengelompokkan (clustering) yaitu dengan melakukan proses segmentasi atau pemecahan data ke dalam sejumlah kelompok (cluster) berdasarkan karakteristik tertentu yang diinginkan. Dalam proses pengerjaannya, label dari setiap data belum diketahui, dan dengan pengelompokkan diharapkan dapat diketahui kelompok data untuk kemudian diberi label yang sesuai dengan keinginan.

Tujuan pengelompokkan (clustering) data dapat dibedakan menjadi dua, yaitu pengelompokkan untuk pemahaman dan pengelompokkan untuk penggunaan. Jika tujuannya untuk pemahaman, kelompok yang terbentuk harus menangkap struktur alami data, biasanya proses pengelompokkan dalam tujuan ini hanya sebagai proses awalan untuk kemudian dilanjutkan dengan pekerjaan lain seperti peringkasan (summarization), pelabelan kelas pada setiap kelompok yang kemudian digunakan sebagai data latih dalam proses klasifikasi Ada banyak jenis-jenis metode pengelompokan yang sudah dikembangkan. Masing-masing metode memiliki karakter, kelebihan, dan kekurangan. Menurut strukturnya, pengelompokan dibagi menjadi dua, yaitu pengelompokkan hierarki dan partitioning. Pengelompokkan hierarki memiliki satu data tunggal yang bisa dianggap sebagai sebuah kelompok, dua atau lebih kelompok kecil dapat bergabung menjadi sebuah kelompok besar dan begitu seterusnya hingga semua data dapat bergabung menjadi sebuah kelompok. Di sisi lain, metode pengelompokkan partitioning membagi set data ke dalam sejumlah kelompok yang tidak overlap antara satu kelompok dengan kelompok yang lain. Dalam hal ini metode tersebut yaitu k-means.

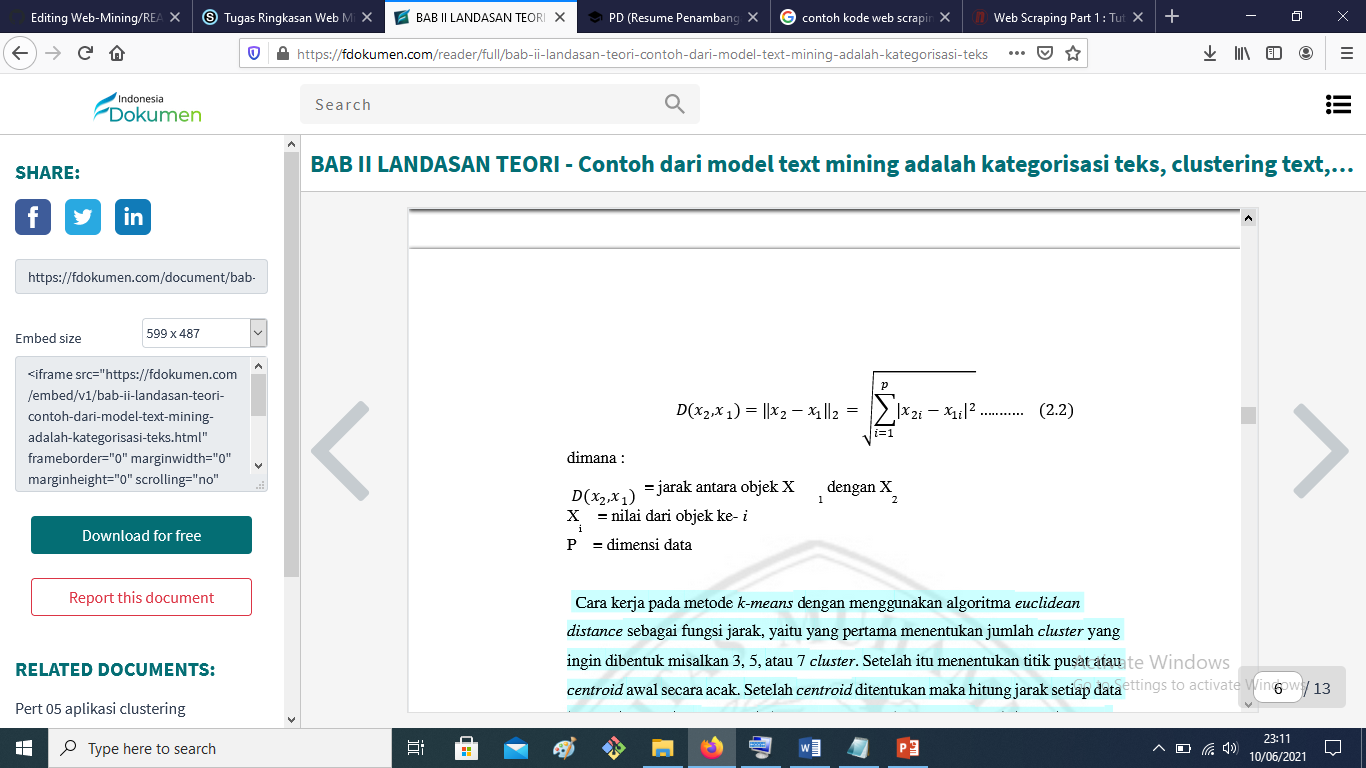
* K-Means Clustering

K-means merupakan salah satu metode pengelompokkan secara partitioning yang berusaha mempartisi data yang ada ke dalam bentuk dua atau lebih kelompok. Metode ini mempartisi sebuah data yang ada ke dalam suatu kelompok sehingga data yang berkarakteristik sama akan dimasukkan ke dalam satu kelompok yang sama dan data yang berkarakteristik berbeda dikelompokkan ke dalam kelompok yang lain [8].Tujuan pengelompokkan data ini adalah untuk meminimalkan fungsi objektif yang di set dalam proses pengelompokkan, yang pada umumnya berusaha meminimalkan variasi di dalam suatu kelompok dan memaksimalkan variasi antar kelompok. Adapun pengelompokkan data dengan metode k-means ini secara umum dilakukan dengan algoritma seperti Algoritma



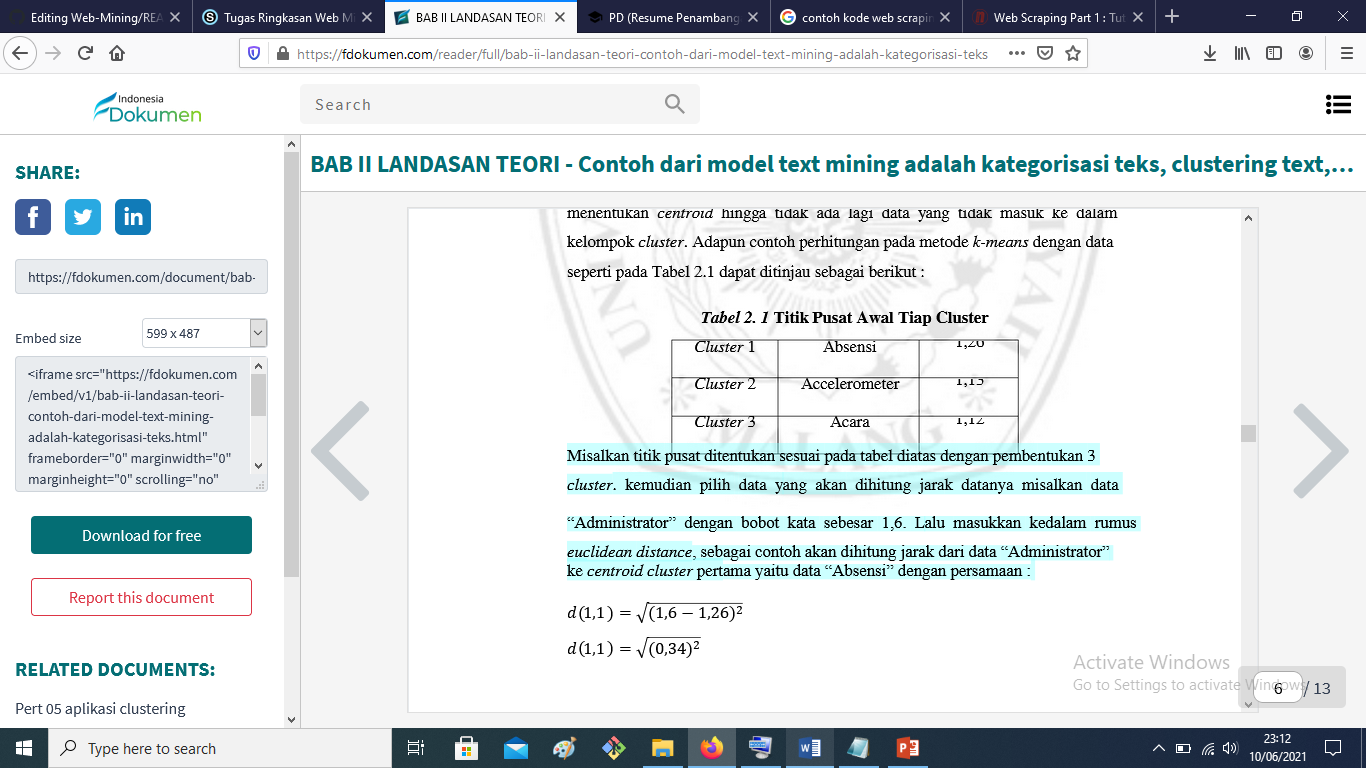
Untuk menghitung jarak similaritas antar objek pada metode k-means diperlukan

algoritma euclidean distance seperti Algoritma.



Cara kerja pada metode k-means dengan menggunakan algoritma euclidean distance sebagai fungsi jarak, yaitu yang pertama menentukan jumlah cluster yang ingin dibentuk misalkan 3, 5, atau 7 cluster. Setelah itu menentukan titik pusat atau centroid awal secara acak. Setelah centroid ditentukan maka hitung jarak setiap data ke masing-masing centroid dengan menggunakan rumus euclidean distance.

Apabila sudah diketahui nilai jarak setiap data, maka mengelompokkan setiap data tersebut berdasarkan jarak yang terdekat dari centroid. Apabila masih terdapat data yang belum masuk ke dalam kelompok cluster, maka ulangi proses dari menentukan centroid hingga tidak ada lagi data yang tidak masuk ke dalam kelompok cluster. Adapun contoh perhitungan pada metode k-means dengan data seperti pada Tabel 2.1 dapat ditinjau sebagai berikut :



Misalkan titik pusat ditentukan sesuai pada tabel diatas dengan pembentukan 3 cluster. kemudian pilih data yang akan dihitung jarak datanya misalkan data “Administrator” dengan bobot kata sebesar 1,6. Lalu masukkan kedalam rumus euclidean distance, sebagai contoh akan dihitung jarak dari data “Administrator” ke centroid cluster pertama yaitu data “Absensi” dengan persamaan :

Dari hasil perhitungan diatas di dapatkan hasil bahwa jarak data “Administrator” dengan centroid cluster yang pertama adalah 0,34.

jarak dari data “Administrator” ke centroid cluster kedua yaitu data “Accelerometer” dengan persamaan :

Dari hasil perhitungan diatas di dapatkan hasil bahwa jarak data “Administrator” dengan centroid cluster yang kedua adalah 0,47.

jarak dari data “Administrator” ke centroid cluster ketiga yaitu data “Acara” dengan persamaan :

Dari hasil perhitungan diatas di dapatkan hasil bahwa jarak data “Administrator” dengan centroid cluster yang ketiga adalah 0,48.

Berdasarkan hasil ketiga perhitungan di atas dapat disimpulkan bahwa jarak data “Administrator” yang paling dengan dengan centroid adalah cluster 1, sehingga data tersebut dimasukkan ke dalam cluster 1.

• Metode k-means

Metode k-means memiliki beberapa ciri khas atau karakteristik dalam clustering data yaitu pertama k-means merupakan metode pengelompokkan yang sederhana dan dapat digunakan dengan mudah. Kedua, k-means tidak dapat melakukan segmentasi data dengan baik dimana hasil segmentasinya tidak dapat memberikan pola kelompok yang mewakili karakteristik bentuk alami data. Ketiga, k-means bisa mengalami masalah ketika mengelompokkan data yang mengandung outlier.

• Hierarchical Clustering

Pengelompokkan hierarki (Hierarchical Clustering) merupakan metode analisis pengelompokkan yang berusaha untuk membangun sebuah hierarki kelompok. Terdapat dua jenis strategi untuk pengelompokkan hierarki, yaitu aglomeratif dan divisif. Pengelompokkan hierarki aglomeratif merupakan metode pengelompokkan yang dengan melakukan pendekatan bottom up. Prosesnya dimulai dari masing-masing data sebagai sebuah kelompok, kemudian secara rekursif mencari kelompok terdekat sebagai pasangan untuk bergabung menjadi satu kelompok yang lebih besar. Proses tersebut diulang terus sampai membentuk sebuah pohon hierarki. Ada tiga teknik kedekatan yang digunakan dalam hierarki aglomeratif, yaitu single linkage atau tautan tunggal, complete linkage atau tautan lengkap, dan average linkage atau tautan rata-rata.

• Metode Single Linkage

Single linkage memberikan hasil bila kelompok-kelompok digabungkan menurut jarak antara anggota-anggota yang terdekat diantara dua kelompok. Kedekatan di antara dua kelompok ditentukan dari jarak terdekat (terkecil) di antara pasangan dua data dari dua kelompok yang berbeda atau disebut juga nilai kemiripan termaksimal. Metode single linkage cocok untuk menangani set data yang dalam bentuk distribusi datanya non-elips, tetapi metode ini sangat sensitif terhadap noise dan outlier.

* Code

#!/usr/bin/env python2

# -\*- coding: utf-8 -\*-

"""

"""

# Importing libraries

from sklearn.feature\_extraction.text import TfidfVectorizer

from sklearn.neighbors import KNeighborsClassifier

from sklearn.cluster import KMeans

from nltk.corpus import stopwords

from nltk.stem.wordnet import WordNetLemmatizer

import string

import re

import numpy as np

from collections import Counter

stop = set(stopwords.words('english'))

exclude = set(string.punctuation)

lemma = WordNetLemmatizer()

# Cleaning the text sentences so that punctuation marks, stop words & digits are removed

def clean(doc):

stop\_free = " ".join([i for i in doc.lower().split() if i not in stop])

punc\_free = ''.join(ch for ch in stop\_free if ch not in exclude)

normalized = " ".join(lemma.lemmatize(word) for word in punc\_free.split())

processed = re.sub(r"\d+","",normalized)

y = processed.split()

return y

print "There are 10 sentences of following three classes on which K-NN classification and K-means clustering"\

" is performed : \n1. Cricket \n2. Artificial Intelligence \n3. Chemistry"

path = "Sentences.txt"

train\_clean\_sentences = []

fp = open(path,'r')

for line in fp:

line = line.strip()

cleaned = clean(line)

cleaned = ' '.join(cleaned)

train\_clean\_sentences.append(cleaned)

vectorizer = TfidfVectorizer(stop\_words='english')

X = vectorizer.fit\_transform(train\_clean\_sentences)

# Creating true labels for 30 training sentences

y\_train = np.zeros(30)

y\_train[10:20] = 1

y\_train[20:30] = 2

# Clustering the document with KNN classifier

modelknn = KNeighborsClassifier(n\_neighbors=5)

modelknn.fit(X,y\_train)

# Clustering the training 30 sentences with K-means technique

modelkmeans = KMeans(n\_clusters=3, init='k-means++', max\_iter=200, n\_init=100)

modelkmeans.fit(X)

test\_sentences = ["Chemical compunds are used for preparing bombs based on some reactions",\

"Cricket is a boring game where the batsman only enjoys the game",\

"Machine learning is an area of Artificial intelligence"]

test\_clean\_sentence = []

for test in test\_sentences:

cleaned\_test = clean(test)

cleaned = ' '.join(cleaned\_test)

cleaned = re.sub(r"\d+","",cleaned)

test\_clean\_sentence.append(cleaned)

Test = vectorizer.transform(test\_clean\_sentence)

true\_test\_labels = ['Cricket','AI','Chemistry']

predicted\_labels\_knn = modelknn.predict(Test)

predicted\_labels\_kmeans = modelkmeans.predict(Test)

print "\nBelow 3 sentences will be predicted against the learned nieghbourhood and learned clusters:\n1. ",\

test\_sentences[0],"\n2. ",test\_sentences[1],"\n3. ",test\_sentences[2]

print "\n-------------------------------PREDICTIONS BY KNN------------------------------------------"

print "\n",test\_sentences[0],":",true\_test\_labels[np.int(predicted\_labels\_knn[0])],\

"\n",test\_sentences[1],":",true\_test\_labels[np.int(predicted\_labels\_knn[1])],\

"\n",test\_sentences[2],":",true\_test\_labels[np.int(predicted\_labels\_knn[2])]

print "\n-------------------------------PREDICTIONS BY K-Means--------------------------------------"

print "\nIndex of Cricket cluster : ",Counter(modelkmeans.labels\_[0:10]).most\_common(1)[0][0]

print "Index of Artificial Intelligence cluster : ",Counter(modelkmeans.labels\_[10:20]).most\_common(1)[0][0]

print "Index of Chemistry cluster : ",Counter(modelkmeans.labels\_[20:30]).most\_common(1)[0][0]

print "\n",test\_sentences[0],":",predicted\_labels\_kmeans[0],\

"\n",test\_sentences[1],":",predicted\_labels\_kmeans[1],\

"\n",test\_sentences[2],":",predicted\_labels\_kmeans[2]