AN AUTOMATIC PROCESSING OF THE NATURAL LANGUAGE IN THE WORD COUNT SYSTEM

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## Summary

We succeeded in making a program having the following four functions:

1. segmenting the Japanese sentence
2. transliterating from Chinese characters (called Kanji in Japanese) to the Japanese syllabary (kana) or to Roman letters
3. classifying the parts-of-speech in the Japanese vocabulary
4. making a concordance

We are using this program for the pre-editing of surveys of Japanese vocabulary.

In Japanese writing we use many kinds of writing systems, i.e. Kanji, kana, the alphabet, numerals, and so on. We have thought of this as a demerit in language data processing. But we can change this from a demerit to a merit. That is, we can make good use of these many writing systems in our program.

Our program has only a small table containing 300 units. And it is very fast. In our experiments we have obtained approximately 90% correct answers.

## Introduction

Obtaining clean date is very important in language data processing. There are two problems here. One is how to input the Japanese text and the other is how to find errors in the data and correct them. The human being is suited to complicated work but not to simple work. The machine, on the contrary, is suited to simple work but not to complicated work. In the word count system using computers, the machine has simple work (sorting, computation, making a list), and the humans have complicated work (segmentation, transliteration from Kanji to kana, classification of parts of speech, finding errors in the data, discrimination of homonyms and homographs, ets.).

However, in this system there is one major problem -- humans often make mistakes. And, regrettably, we cannot predict where they will make them. Thus we decided to make an automatic processing system. This system has to be compact, fast, and over 90% accurate.

In Japanese writing we generally use many kinds of writing systems.
For example,

ＣＯＬＩＮＧ８０が東京の都市センターホールで開催された。

In this example sentence we find used the alphabet (C, O, L, I, N, G), numerals (8, 0), kana (hiragana --the Japanese cursive syllabary -- が, の, で, さ, れ, た, and katakana -- the Japanese straight-lined syllabary --セ, ン, タ, ー, ホ, ー, ル), Kanji ( 東, 京, 都, 市, 開, 催 ), and signs (.). And as you can see, there are no spaces left between words. This makes Japanese data processing difficult.

Our program makes good use of these different elements in the writing system. At present the automatic processing program makes more mistakes than humans do. But we can predict where it will make them and easily correct errors in the data.

## Objective

Our objective is a system having the following functions:

1. segmentation
2. tranliteration from Kanji to kana
3. classification of parts of speech
4. adding lexical information by use of a dictionary
5. making a concordance
6. making a word list

Numbers 1, 2, and 3 are especially important for our program. Our report will mainly deal with these three functions.

The input data is generally a text written in Japanese. The output is a concordance sorted in the Japanese alphabetical order, giving information of the parts of speech, and marked with a thesaurus number.

## System

Figure 1 is a flow chart of our program.

Input is by magnetic tape, paper tape, or card. The input code is the NLRI (National Language Research Institute) code or some other code. Of course we have a code conversion program from other codes to the NLRI code.

The second block of Figure 1 shows what we call the automatic processing of natural language. In the supervisor square we check and select the results of the three automatic processing programs. Some of these programs have many kinds of processing of natural language . For example, the automatic segmentation program involves the classification of parts of speech, automatic syntactic analysis, automatic transliteration from Kanji to kana, and so on. (An example will be found in the next section.)

In the adding lexical information block of Figure 1, we make use of the dictionary obtained by research into some 5 million words at the NLRI. This dictionary includes word frequencies, parts of speech, classes by word origin, and a thesaurus number.

By using the concordance we can find and correct errors in the data. As our program is unfortunately not always complete, this concordance is very useful.

In the output block of Figure 1 we can choose a variety of output devices -- an alphabet line printer, a kana line printer, a high-speed Kanji printer, or a Kanji display.

## Method

1. Automatic transliteration from Kanji to Roman letters

The Chinese characters have many different readings in Japanese. For example,

生 / sei/ /syo/ /um-/ /iki/ nama/ /ai/
立 / tachi/ /tatsu/ /tate/ /dachi/ /ritsu/ /rittoru/
一 / ichi/ /itsu/ /kazu/ hajime//hito/

We have to arrange the Japanese words in the Japanese alphabetical order.
The program puts the reading way to each word for the word list.

The method of selecting the reading is to choose it in accordance with the surroundings of the Kanji in the text. The possible readings for each Kanji are listed in a small table. The records in this table are of 3types- Groups1,2, and 3 represented by numbers 1;2,3; and 4,5, 6 respectively in Figure 2.

The Kanji in Group 1 have one reading each. The program replaces the Kanji with this reading. In Figure 2, No. 1 falls into this category. We have about 700 Kanji in Group 1 (院,堂,族,字,批, ets.).

The Kanji in Group 2 have tow or more readings each. In Figure 2, Nos. 2 and 3 fall into this category.

The format for these entries is group number, the Kanji, the operation code (a numeral or Capital letter), and the reading (up to 8 small letters).

The appropriate reading is chosen for the situation of the Kanij in accordance with Table 1.

| situaton | | operation letter | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| front | behind | A | 1 | B | 2 | C | 3 | D | 4 | E | 5 | F | 6 | G | 7 | H | 8 |
| unti | unti | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| unti | Kanji | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| Kanji | unti | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| Kanji | Kanji | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |

0: replace Kanji to reading in the table
Table 1. Operation of situation

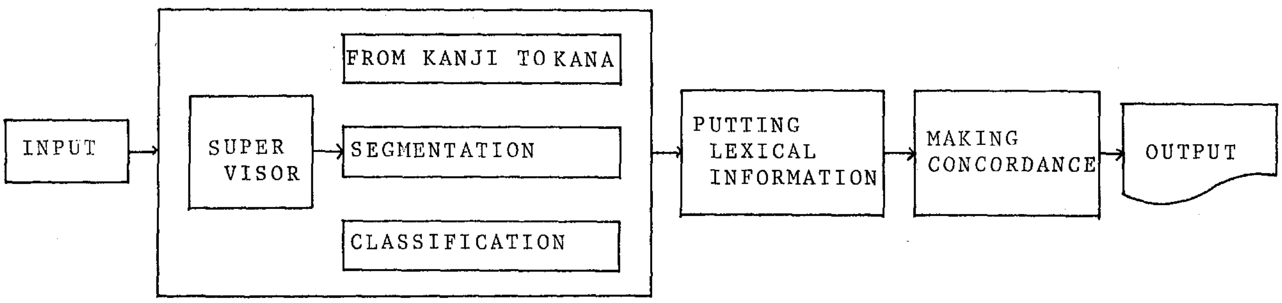



Figure 1. A flow chart

(1)1 校KO#U ④

(2)2 歌 1 KA A#UTA ④

(3)2 河 1 KA AKAWA ④

(4)3 川 1 8 SENN 2 H KAWA ＊M 河 1 N 柳 1 ④

(5)3 泳 1 1 #E#I 2 A#OYO ＊M 平 2 N ぎ 2 ④

(6)3 水 1 1 SU#I 2 AMIZU ＊M 大 2 N 気 2 ④

Figure 2. Table of Kanji reading

| (Input) | (Output) |
|---|---|
| (1) 校歌を歌う. | KO#UKAWO#UTA#U. |
| (2) 川で泳ぐ. | KAWADE#OYOGU. |
| (3) 河川で水泳をする. | KASENNDESU#I#E#IWOSURU. |

Figure 3. result of experimentation

Figure 3 gives a sample of the results of our experiments. The Kanji/歌/in no. 1 here is a group 2 Kanji. Its situation in the context /校歌を/is that in front of it is the Kanji /校/ and behind it is the non-Kanji/を/ . When the context is Kanji + non-Kanji, the program selects reading 1/ka/. The situation of/歌/ in context /を歌う/is non-Kanji + non-Kanji so the reading A/#uta/ is selected. AS a result /校歌を歌う/ is transliterated to /ko#ukawo#uta#u/.

Group 2 contains 1500 Chinese characters.

The Kanji in Group 3 have a special reading in a special context in addition to their regular meanings. In Figure 2, Nos. 4, 5, and 6 are in this group. In Figure 3,/川/in No. 2 can be processed without a special reading, but in no. 3 the special reading is needed. To obtain this reading, the special context after the the sign * is applied. The format, as in Figure 2, no. 4, is group number (3), Kanji (川), reading number (1, 2), operation code (8, H), reading, sign (*), code for front or behind(M, N), Kanji (河 , 柳 ), and applied reading number(1, 1).

| | | (e.g.) |
|---|---|---|
| Groupe number | 1 letter | 3 |
| Kanji | 1 | 川 |
| Reading number | 1 | 1 2 |
| Operation's letter | 1 | 8 H |
| Reading way | 8 small letter | SENN KAWA |
| Sighn | 1 letter | * |
| Sighn of front or behind | 1 | M N |
| Caracter | 1 | 河 柳 |
| Applied reading number | 1 | 1 1 |

In this case reading number 1 is applied because/河/is found in front of/川/.

The merits of this method are that the table is small and the process fast. If we had a table listing vocabulary rather than Kanji, it would be much larger , requiring at least 70,000 entries. One demerit is that the process does not completely cover all cases. The phenomenon of rendaku or renjo, in particular, requires special contexts. There are no rules for this. Examples of rendaku and renjo are follows:

| | | (in English) |
|---|---|---|
| 本箱 | /hon/+/hako/-->/honbako/ | bookcase |
| 子供 | /ko/+/tomo/-->/kodomo/ | child |
| 天皇 | /ten/+/ou/-->/tennou/ | emperor |
| 因縁 | /in/+/en/--> /innen/ | karma |
| 酒屋 | /sake/+/ya/-->/sakaya/ | wineshop |

## 2. Automatic segmentation

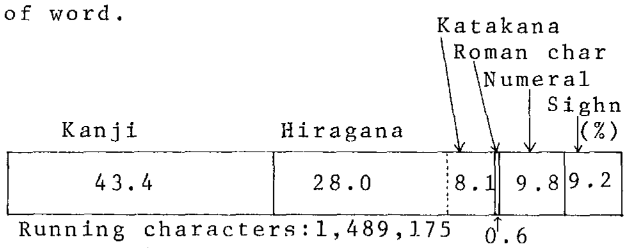
We do not use spaces between words in Japanese, but we do use many different elements in our writing system. There are Kanji, kana (hiragana and katakana), the alphabet, numerals, and signs. Figure 4 shows the ratio of these elements in Japanese newspapers. If we look at a Japanese text as a string of different kinds of characters, we can replace the characters of a Japanese sentence with the abbreviations of Table 2.

AM. 10 にバスに乗る .
446 55 2 3 3 2 1 2 6

In Japanese composition we are taught the proper use of the different characters in this way:

- Kanji - to express concepts; more concretely, for nouns, the stems of verbs, etc.
- hiragana - for particles, auxiliary verbs;*1 the endings of verbs and adjectives, writing phonetically, etc.
- katakana - for borrowed words, foreign personal and place names, onomatopoeia, etc.
- alphabet - for abbreviations
- numerals - for figures

Therefore, if the different characters are used properly they suggest the type of word.




Running characters:1,489,175

Figure 4. Ratio of characters on newspaper

We checked the character combinations. The ratio of segmental point to the character combinations is as follows.

| behind / front | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. | 5.7 | 61.7 | 45.2 | 75.0 | 100.0 | 73.8 |
| 2. | 92.1 | 40.8 | 95.7 | 100.0 | 100.0 | 95.1 |
| 3. | 25.4 | 89.5 | 1.0 | --- | --- | 33.3 |
| 4. | 2.8 | 100.0 | 100.0 | 13.2 | 0.0 | 90.0 |
| 5. | 2.7 | 100.0 | --- | 100.0 | 0.0 | 75.0 |
| 6. | 98.2 | 84.7 | 62.1 | 33.3 | 23.7 | - |

(%)

1: Kanji, 2: Hiragana
3: Katakana 4: Alphabet
5: Numeral 6: Sighn
Object: 15,677 characters

Table 2. A ratio of segmental point

We can segment at character combinations with a high ratio in Table 2 but not at those with a low ratio.

For our program we converted Table 2 to the form found in Table 3. We can segment a sentence at the places where numeral 1 is found in the table.

| behind / front | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 Kanji | 0 | 1 | 0 | 1 | 1 | 1 |
| 2 Hiragana | 1 | 0 | 1 | 1 | 1 | 1 |
| 3 Katakana | 0 | 1 | 0 | 0 | 0 | 0 |
| 4 Alphabet | 0 | 1 | 1 | 0 | 0 | 1 |
| 5 Numeral | 0 | 1 | 0 | 1 | 0 | 1 |
| 6 Sighn | 1 | 1 | 1 | 0 | 0 | 0 |

Table 3. Table for segmentation by character combination

| | |
|---|---|
| 1が | 1R |
| 4こうした | 2C 1E91P |
| 1た | 1P+ |
| 1で | 1Q9 |
| 1の | 1R |
| 1れ | 1P# |

Figure 5. Table for segmentation and Classification of parts of speech

Hiragana-Hiragana type is use of the second most frequent combinations in Japanese. According to Table 2, We are unable to segment for this combination. Therefore we make the following rule.

The hiragana/を/is used only as a particle and we always segment at it. The other hiragana characters are segmented according to the character string table found in Figure 5. The format, as in the second line in Figure 5, is the number of characters in the string (4), the character string (up to 10 characters) (こうした), the length of the words (2, 1, 1), the parts of speech (C, E, P), and the conjugation (9).

This table contains only 300 records. These are the particles, auxiliary verbs*1, adverbs, and character strings which cannot be segmented by Tabie 3 (ex.こうした in Figure 5).

This table is applied as follows. The program first searches the character strings of the table in the input sentences. If a character string (こうした) fits part of an input sentence (こうした時には…), then the program segments it into parts by the lengths of words in the table and adds the information about the parts of speech and conjugation. As a result we obtain the words (こう/し/た/).

Figure 6 shows the results of automatic segmentation and automatic transliteration from Kanji to Roman letters. The operation of Table 3 has resulted in no segmentation for the strings (/COLING80/), (/東京/), (/都市センターホール/), and (/開催さ/) as well as the segmentation at the sign (/./). The operation of the table in Figure 5 has resulted in the segmentation for the hiragana (/が/), (/の/), (/で/), (/れ/), and (/た/).

## 3. Automatic classification of parts of speech

In order to analyze the vocabulary we have to classify it by parts of speech. The program dose this by three methods.

The first method is by using the table found in Figure 5.

The second method is by the form of the word, applying the rules below. The ratio of correct answers obtained is given in parentheses after each rule.

1. If the last character of the word is in Kanji, katakana,or the alphabet, then the word is a noun. (94.4%)
2. If the last character is/い/, then it is a verb in the renyo form (conjugation) or an adjective in the syushi or rentai form. (86.2%)
3. If the last character is/く/, then it is a verb in the syushi or rentai form or an adjective in the renyo form. (83.4%)

ＣＯＬＩＮＧ８０が東京の都市センターホールで開催された.
ＣＯＬＩＮＧ８０ が 東京 の 都市センターホール で 開催さ れ た .
C O L I N G 8 0 GA TO#UKIJO#U NO TOSISENNTAO HOO RU DE KA#ISA#ISA RE TA .

遊びにあきた子供らが帰っていく.
遊び に あき た 子供ら が 帰っ て いく .
#ASOBI NI #AKI TA KOTOMORA GA KA#EQQ TE #IKU .

ジョン.Ｆ.ケネディは偉大な大統領だった.
ジョン.Ｆ.ケネディ は 偉大 な 大統領 だっ た .
ZIJONN. F . KENEDE*I HA #IDA#I NA DA#ITO#URIJO#U DAQQ TA .

パン粉を１００gか，１００円分ください.
パン粉 を １００g か ， １００円分 ください .
PANNKO WO 1 0 0 G KA , 1 0 0 #ENNBUNN KUDASA#I .

Figure 6. Result of Segmentation and Transliteration from Kanji to Roman character

4. If the last character is/る/, then it is verb, <u>syushi</u> form. (95.8%)
5. If the last character is/れ/, then it is verb, <u>katei</u> form, or demonstrative pronoun, or auxiliary verb*1 (92.9%)
6. If the last character is/ろ/, then it is verb, <u>meirei</u> form, or noun. (63.3%)
7. If the last tow characters are/かっ/, then it is adjective, <u>mizen</u> form, or verb, <u>renyo</u> form. (74.2%)
8. If the last character is /っ/, then it is verb, <u>renyo</u> form. (79.6%)
9. If the last tow characters are <u>Kanji</u>-<u>hiragana</u>, then it is a verb. (94.4%)
   If the vowel of the last <u>hiragana</u> is /a/, then its conjugation is mizen or renyo form, and
   if it is /i/, then it is <u>mizen</u> or <u>renyo</u>
   if it is /u/, then it is <u>syushi</u> or <u>rentai</u>
   if it is /e/, then it is <u>katei</u> or <u>meirei</u>
   if it is /o/, then it is <u>meirei</u>
10. If the last character is a numeral, then it is a figure and if it is a sign, then it is a sign.

The third method is by word combinations. That is, in Japanese grammer word combination -- especially of nouns or verbs and particles or auxiliary verbs*1 -- is not free. The formula given in Figure 7 is made from this rule.
Its format is as follows:

1. the word
2. its part of speech
3. auxiliary verbs*1 or particles which can be used in front of this word
4. parts of speech and conjugations which can be used in front of this word
5. if 3 and 4 do not agree then 5 applies obligatorily.

Figure 8 is the result of automatic classification of parts of speech. The explanation of the codes used in it is as follows:
1 (noun). E (verb), M (adjective)
P (auxiliary verb)*1, R (particle)
C (adverb), A (conjanction), B(interjection), Y (sighn), X (figure)

(1) (2) ——— (3) ———
を＠Ｒ＠＃と＃から＃まで＃の＃だけ＃ばかり＃こそ＃さえ＃すら＃のみ＃など＃ぐらい
＃ 1 ／1 ＠ ＠
(4) (5)

Figure 7. table for Classification of parts of speech

(1) 祭りを待っている.
(2) 祭り を 待っ て いる .
(3) MACURI WO MAQQ TE #IRU .
(4) ER ER EY
(5) # 9 +
(6) 1R ER EY
(7) 9 +

Figure 8. Result of Classification of parts of speech

Q (auxiliary verb[*1] or particle)
8 ('mizen' form), 9 ('renyo' form)
# ('mizen' or 'renyo' form)
+ ('syushi' or 'rentai' form)

The steps in Figure 8 are
1. input data
2. the result of segmentation
3. the result of transliteration from <u>Kanji</u> to Roman letters
4. the automatic classification of the parts of speech by methods 1 and 2 (by table and by word form)
5. the conjugations

| char. | char.'s freq. | word's freq. aux.v. & part. | other |
|---|---|---|---|
| の | 38404 | 32588(84.9%) | 2( 0%) |
| い | 23633 | 2(0.0%) | 1305( 5.5%) |
| し | 22124 | 64(0.3%) | 13138(59.4%) |
| に | 18962 | 17037(89.8%) | 3( 0.0%) |
| と | 16383 | 10173(62.1%) | 0( 0%) |
| は | 16062 | 13324(83.0%) | 0( 0%) |
| た | 15958 | 10569(66.2%) | 1( 0.0%) |
| る | 15522 | 17( 0.1%) | 0( 0%) |
| を | 14710 | 14702(99.9%) | 0( 0%) |
| で | 13515 | 8351(61.8%) | 00( 0%) |

Figure 9. Result of supervisor

6. automatic classification by method 3, resulting in /祭り/ being changed from a verb to a noun (using the formula for/を/found in Figure 7 ).

## 4. Supervisor

The supervisor program checks the results of the three automatic processing programs and selects the correct results or processes feedback. It also utilizes information obtained through each program. That is,
1. The results of the character check

(1) 沢山の木をたばねられませんでした.

沢山 の 木 を た ば ね られ ませ ん でし た .
TAKUSANN NO KI WO TA BA NE RARE MASE NN DESI TA .
1R1RPRQ P PP PPY
+ Q # #+ 9+
沢山 の 木 を たばねら れ ませ ん でし た .
TAKUSANN NO KI WO TABANERA RE MASE NN DESI TA .
1R1R EP PP PPY
8# #+ 9+

(2) 面白くて遊び過ぎた.

面白く て 遊び 過ぎ た .
#OMOSIROKU TE #ASOBI SUGI TA .
EMR E EPY
+9 # #+
面白く て 遊び過ぎ た .
#OMOSIROKU TE #ASOBISUGI TA .
EMR EPY
+9 9+

Figure 10. Result of supervisor

and conversion from kana to Roman letters are used for each program.

2. The information obtained in automatic transliteration is used in segmentation.
   Namely, if the special context is applied, then the program does not segment at that point because the character string is a word.
3. The information obtained at the conversion from kana to Roman letters is used in segmentation.
   Namely, if the consonant of the Romanized Japanese is (*), (J), or (Q)-- these are used as special small characters in kana -- then the program dose not segment at that point.
4. The information obtained in segmentation is used in classification.
   Namely, the program obtains information concerning parts of speech and conjugation through using the table in Figure 5 in segmentation.

Checking the results of the processing involves the following:

1. Checking particle and auxiliary verb strings obtained by the program at classification. If these strings are impossible in Japanese, then the segmentation was mistaken. The program corrects these.
2. There are not many words composed of one character in Japanese except for particles and auxiliary verbs. Figure 9 gives the frequency of some characters and the frequency of words consisting of that character alone.
   Words of high frequency that are not particles or auxiliary verbs are produced by errors in segmentation. The program then corrects these errors, combining them into longer words.
3. If a verb in the renyo form is followed by another verb, then it is a compound word and the program corrects the error to produce a longer word.
   Figure 10 shows the results of the supervisor program. In test sentence 1, the program at first segmented /た/ば/ね/ら/ as auxiliary verbs through the use of the table in Figure 5. But the supervisor program checks and corrects this string and the classification program adds the information of verb to/たばねら/,*2 as can be seen in Figure 10.
   In test sentence 2, the program at first segmented it /#ASOBI/SUGI/TA/, but the supervisor program checked this and corrected this string to the compound word, /#ASOBISUGI/,plus /TA/.

We can process Japanese sentences using these methods and obtain words and various information about these words. With this program we can obtain a rate of correct answers of approximately 90 percent.*3

We should be able to improve this program at the level of the supervisor and the tables. However, we don't think that it will be possible to obtain 100 percent correct answers because this system uses Japanese writing and the Japanese writing system is not 100 percent standardized. In addition, if we wish to produce a complete program, it is necessary to process on the basis of syntax and meaning. At persent, this is not the object of our efforts.

## 5. Adding lexical information

The National Language Research Institute has been investigating the vocabulary of modern Japanese since 1952, and has been using the computer in this research since 1966. As a result, some five million words are available as machine readable data. This data contains various information such as word frequency, part of speech, class by word origin, and thesaurus number. The thesaurus, Bunrui goihyo in Japanese, was produced by Doctor Oki Hayashi. It contains about 38,000 words in the natural language of Japanese.

## 6. Making the concordance

We will not explain this program here since we have written a separate report about it (number 6 in the list of references below). Please refer to this report for further details.

Figure 11 is the result of this process.


## Acknowledgements

Professor Akio Tanaka developed this plan, made a prototype for automatic transliteration from Kanji to kana, and permitted us to use this program.
Mr. Kiyoshi Egawa made a prototype for an automatic segmentation program and permitted us to use it. They also contributed to this study through our

discussions with them. Mr. Oki Hayashi furnished us with the opportunity to study this and provided his support for our efforts.

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Notes:

*1 Auxiliary verb : This term means the bound form which conjugate. It is put Jodoshi in Japanese.

*2 /たばねられ/ is rightly segmented for /たばね/ and /られ/. This case is an error of program.

*3 A ratio of correct answers is follows.
Sample : 2500 words from a high school textbook
Segmentation : 91.3%
Transliteration from Kanji to Kana : 95.7%
Clasification of parts of speech: 97.0%

| WORD | WORD NUMBER | ROMANIZED JAPANESE | PARTS SPEECH | THESAURUS NUMBER | KEYWORD IN CONTEXT | | |
|---|---|---|---|---|---|---|---|
| 家 | 01421 | =I=E | 1 | 1.202 | 族の人間関係においても, | 家 | そのものを重視関係から, 家族員 |
| いえ | 01224 | =I=E | E | 4.321 | り, かならずしも賢明とは | いえ | ない消費に熱中したり, また, |
| いえる | 00224 | =I=ERU | E+ | | の実感をともなった現象と | いえる | . しかし, 消費物資の氾濫, |
| いえる | 01769 | =I=ERU | E+ | | きかたがつくられていると | いえる | . 倫理社会P084>れくら |
| いかなけ | 01949 | =IKANAKE | E8 | | をポリス生活の原理として | いかなけ | ればならないと説いた. こ |
| 生き | 01719 | =IKI | E= | | つの傾向は, すべての人の | 生き | かたのなかに, 多かれ少なかれ |
| 生き | 01761 | =IKI | E= | | によって, それぞれの人の | 生き | かたがつくられているといえる |
| 生き | 02080 | =IKI | E= | | が道徳的で義務にかなった | 生き | かたであると考えた. ストア派 |
| 生き | 02495 | =IKI | E9 | | 一・久であり, このように | 生き | ては倫理社会P167> 1現代 |
| 生き | 01146 | =IKI | 1 | | る. そこで, 人間としての | 生き | がいや主体性の回復を, 組織外 |
| 勢い | 00469 | =IKI=O=I=I | 1 | 1.1403 | うな商品さえもめざましい | 勢い | で普及し, また労働生産性の向 |
| 生きる | 02070 | =IKIRU | E+ | 2.581 | ロゴスの秩序にしたがって | 生きる | ことが道徳的で義務にかなっ |
| 生きる | 02327 | =IKIRU | E+ | 2.581 | において, 他者への真実に | 生きる | ことがたいせつであるという |
| 生きる | 02524 | =IKIRU | E+ | 2.581 | ことは, 現代という時代に | 生きる | 人間が, なにを課題とし, # |
| 生きる | 01370 | =IKIRU | E+ | 2.581 | えない. これからの社会に | 生きる | 倫理社会P039>すなわち |
| 生きる | 02128 | =IKIRU | E+ | 2.581 | ロゴスの秩序にしたがって | 生きる | という考えは, 近代自然法思 |
| いく | 01278 | =IKU | E+ | | その生産的な性質を弱めて | いく | のである. このよりに, 産業社 |
| いく | 00433 | =IKU | M9 | | 大衆社会的性格を濃くして | いく | のである. 生活水準の平均化大 |
| いく | 00520 | =IKU | M9 | | 心が, 大衆の関心となって | いく | ところに大衆社会のひとつの特 |
| いこう | 01621 | =IKO=U | 1 | 2.332 | らきかけ, それを変革して | いこう | とする態度である. 人生は不 |
| いこう | 01667 | =IKO=U | 1 | 2.332 | 身の欲求と自我を制御して | いこう | という態度である. 他人と交 |
| 以後 | 00025 | =IGO | 1 | 1.1670 | 業革命を開始したが, それ | 以後 | , 産業の近代化の速度はめざま |
| 意志 | 00340 | =ISI | 1 | 1.3045 | 分野において大衆の欲望・ | 意志 | ・動向などが無視できない要素 |
| 意識 | 00258 | =ISIKI | 1 | 1.3000 | 会では, 人人の生活水準や | 意識 | がしだいに平均化し画一化する |
| 意識 | 00551 | =ISIKI | 1 | 1.3000 | を高め, その重要性を強く | 意識 | させることになった. 情報化社 |
| 意識さ | 00950 | =ISIKISA | E8 | | に社会的限界のあることも | 意識さ | れはじめている. そして, や |
| 意識内容 | 00285 | =ISIKINA=I | 1 | | 大部分の人人の生活状態や | 意識内容 | が平均化し, 似かよってく |

Figure 11. Concordance of a high school textbook