

## **Toward Automatic Support For Japanese Lay Judge System – – Processing Precedent Factors For Sentencing Trends Discovery**

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### **Abstract**

*In this paper we investigate factors that influence trends in sentencing process basing on newspaper articles in order to find lexical clues for automatic trial verdict estimation. We examine verdicts for murder cases of the last 10 years using 149 newspaper articles (1998-2001) and 160 precedents from a database available online (2001-2007). The results showed that there is a tendency to give stricter verdicts for murder cases and clustered by CLUTO into five classes were judged as descriptive factors related to a crime method and lethal weapon usage. We also use similarity between cases for sentence estimation after filtering out inadequate factors by using previously retrieved precedents. Finally we confirmed that using similarity-based weights gives less erroneous sentence*

*estimation than the baseline method lacking those weights.*

**Keywords:** *Japanese Lay Judge System, Supporting Tool, Sentence Estimation.*

### **1 Introduction**

In our research we concentrate on utilizing vast amounts of textual data as newspapers and precedents in order to retrieve specific information and present it to a user by visualizing the extraction results, which helps to understand them. In this paper we describe our system for estimating verdicts, which is supposed to help law amateurs with searching and analyzing past cases. According to a new Japanese law regulations, until May 2009 there will be a new lay judge system

implemented in order to guarantee citizens their participation in trials. Until now, only the professional judges had the right to decide on verdicts, but from the next year any of Japanese adult can be chosen to act as a lay judge who will accompany the professionals in sentencing process. A lay judge will have to help in deciding if a suspect is guilty or not and if guilty - what kind of sentence is appropriate. However, it is difficult for a citizen without law knowledge to estimate the verdict because even if antisocial characters of a crime, its cruelty or maliciousness are recognized properly - an objective and adequate assessment of culpability is not an easy task. Therefore ability to display margins of possible sentencing with an easy access to the cases' documents becomes beneficial for a lay judge. Our goal is to build a system with such ability in order to support Japanese lay judges during their preparations for sentencing with professional judges[1, 2, 3, 4, 5].

When it comes to the actual court, sentencing process is often based on estimations. According to the technical reports of E-Filing Research Group of The Committee for Judicial Reform and Advanced Technology<sup>1</sup>, "even under the new judging system it is necessary to discuss the verdict upon some sentence estimation". To estimate a sentence one needs data on past cases and it would be ideal for a lay judge to read all of relevant precedents before attending the discussion, however it is a big burden for an inexperienced person.

For this reason it is expected[6] that the verdict estimations will have to be explained by professional judges by giving examples based on similar precedents and we think that existence of a system estimating verdicts would lead to make judges work easier. One of the reasons for introducing the lay judge system was "trial of eliminating the approach differences between the general public and professional judges while assessing the culpability" and we also agree that there is no need to estimate a verdict blindly following the similar precedents. However, it is not equivalent to having no knowledge on such estimations at all. We think that it would be more preferable to know the estimations to make the approach differences clearer - this should lead to more fruitful verdict discussions. On the other hand, there are opinions claiming a danger to bringing media influences into the court together with lay judges. For example, if a lay judge witnesses the case details by often exaggerating mass-media, then it becomes more likely his view on the sentence will be more severe. There will be an important need to perform detailed research on such media influence. But for time being we are in stage of preparations for the new lay judge system and it is rather impossible to forecast the scale of such outside pressure, as no empirical data on the topic exists yet. Therefore we presumed that media influence will probably take place and decided to use newspaper articles and precedents

<sup>1</sup><http://www.legaltech.jp/>

data available from online sources to perform tests. It is an important task to calculate the possible sentence estimation for a lay judge especially when we want to investigate the influence of media-created public opinion.

During an actual trial, in addition to objective facts, there are many subjective factors appearing between defendant and the judges - these factors are very hard to be described with words but they affect the sentencing. And we realize that it is almost impossible to determine the estimation only by the descriptions from newspaper articles or precedents. However, there are verdict estimations based on precedents and if we loosely define the "estimation" as a margin - we believe it is possible to determine it only by using written resources. Consequently, we first investigate to what extent we are capable to calculate the estimation using only newspaper articles and precedents data. There is various research on legal texts and [7, 8, 9, 10] can be given as examples. However, Harada et al [7] or Egoshi et al [8] aim at searching precedents and do not consider any support for lay judges who are going to discuss sentences. On the other side, Ishizuka [9] or Yamada et al [10] aim at supporting people who do not understand legal jargon but they do not show any interest in proposing sentences at the court. Our goal is to create a supporting tool for helping lay judges in proposing an adequate verdict and for this reason our work is original. In this paper we first analyze newspaper articles, precedents and sentencing trends to investigate factors that affect sentencing, and then we examine cue words from the text to appear at the sentencing as a result of the estimation.

The structure of this paper is as follows. Section 2 explains characteristic features of Japanese lay judge system and the duties will be put on a lay judge. Section 3 describes the overall image of our system for supporting future lay judges. In section 4 we analyze trends of sentences according to newspaper articles and precedents data. In section 5 we introduce the results and considerations of estimation experiments we performed. We conclude our paper with section 6.

## 2 Japanese Lay Judge System

Usually there are two different types of juridical systems where citizens play active role in a trial - jury system and lay judge system. The lay judge system is adopted in Germany, France, and Italy, while in United Kingdom and the United States, the jury system is in force. Below we underline main differences between jury, lay judge and Japanese lay judge systems which are also summarized in Table 1.

In the jury system, citizens inquire into a case independently of the professional judges, but in saiban'in system jurors and professional judges consult with each other on an equal basis. Moreover, jurors in jury

**Table 1. Comparison of Usual Jury Systems and Japanese Lay Judge System**

	Jury Systems	Lay Judge Systems	Japanese Lay Judge System
Pro Judges Participation	only jurors	together with jurors	together with jurors
Decision of guilt	yes	yes	yes
Decision of sentence	no	yes	yes
Length of assignment	for a case	tenure	for a case
Jury selection	at random	recommendation	at random

system basically only authorize the fact of crime and the judge decides on sentence according to the law which fits the case best in his opinion, while jurors in the Japanese lay judge system will not only authorize the fact of crime but also decide sentencing (professional judges are supposed to determine suitable law only). A lay judge is elected for a tenure because high degree of professionalism is requested, while a Japanese lay judge will be selected at random for each case. As the same level of professionalism is needed, short-term duty will bring a danger of having too little experience for a lay judge to determine appropriate sentencing.

Another problem is that until now there were only professional judges in Japan and citizen participation in trials practically never existed. All the information on crime and punishment has been passing to the society mostly through mass media. Principally Japanese law is based on “no punishment when questionable” policy, although Japanese media tend to show suspects as a culprits. It is obvious that court must be independent and unbiased, but in many cases it is difficult to sentence without being influenced by outside factors. For such reasons the use of past cases documents on judicial precedents is highly recommended to help keeping objectivity of judgment and easy access to such data should be supported by NLP techniques tailored for field of legal texts.

Even if a lay judge is not influenced by mass media and does not lose his or her objectivity, it still will be a problem to decide on the sentence for a person without legal experience. In Japan penal regulations regarding punishment of given type of crime are stated in Criminal Code, though there are many factors which influence the final sentence. For example in case of homicide, there is a wide range of possible verdicts from 5 years of imprisonment, through life imprisonment to capital punishment. Even if the commitment of murder is an undeniable fact, circumstances can influence the sentence (for instance drastically changing the length of imprisonment), however such calculation is a very difficult task without knowledge on similar cases.

A duty of applying a correct law to given case belongs to a professional judge but a lay judge still has to realize all the specificity of a crime being analyzed – it may be a homicide, an involuntary manslaughter

or manslaughter by negligence. In Japan it is clearly stated what punishment comes with which type of crime – death sentence for homicide, more than three years for involuntary manslaughter, less than five hundred thousands yen for manslaughter by negligence, etc. Difference between homicide and involuntary manslaughter lies in whether somebody had murderous intent or not, and difference between involuntary manslaughter and manslaughter by negligence lies in whether somebody had intention to hurt other person or not. Therefore, if one person hits another person in order to cause injury but had no intention to take life, life imprisonment or death penalty are not appropriate. However, an amateur can easily neglect objective analysis, especially under the influence of emotions, and forget about taking all the aspects into consideration. A tool which would make a lay judge analyze the case by comparing it to similar cases by inputting all available factors is desirable and this is the main reason we want to propose system extracting features of culpability assessment from precedents to support lay judges in their sentencing process.

### 3 Outline of Our System Structure

During verdict discussion described in Section 2 it will be probably a common situation where a lay judge has a different point of view on the sentence estimation. In such a case, this will be rather difficult to effectively participate the discussion without knowing on what grounds an estimation was done and what kind of facts and factors influenced it. For this reason we think it is not enough to output precedents and a sentence estimation, it becomes also important to show a judge, in an easily understandable manner, what factors influenced given verdicts. Overall flow of our system for supporting lay judges is shown in Figure 1. The system consists of 3 modules. They are “sentencing factors analyzer”, “sentence estimator” and “visualizer”. They are three crucial elements for the final estimation process.

#### 3.1 Sentencing Factors Analyzer

Lay judges are handed large amounts of documents about the target case such as statements of the defendant. Those documents are written in natural lan-

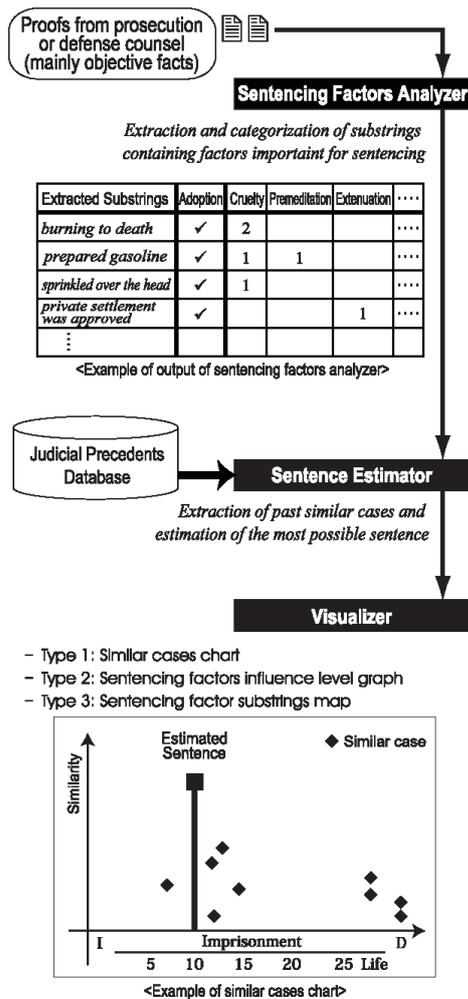


Figure 1. Overall Structure of Our System

guage. Our system analyzes those texts and extracts substrings which have influence on sentencing. Extracted substrings are mainly objective facts on the criminal act. Some strings have tendencies to make punishment heavier, and others to make it lighter. The substrings are converted into parameters of sentencing factors. Those parameters are mainly subjective opinions about the substrings. Parameters are given by the system initially. Then a lay judge can change them manually to match his/her own opinion. This element of our system is supposed to automatically analyze what factors influence the variation of verdicts and to help producing parameters which can be changed by a user during visualization process. Its details are described in [5].

### 3.2 Sentence Estimator

Substrings which are extracted from handed documents are input to sentence estimator as features of the target case. Subjective opinion parameters are also input as features. System selects similar cases from large

amount of past cases by a classifier such as SVM, or similarity calculation. This element is designed to estimate the verdict which is output to the user in the visualization stage and its results can change interactively when a user modifies the parameters.

### 3.3 Visualizer

The visualizer generates visual output to a lay judge. There are 3 types of output, “similar cases chart”, “sentencing factors influence level graph” and “sentencing factor substrings map”. “Similar cases chart” shows an estimated value of an assessment of a case and distribution of past similar precedents. “Sentencing factors influence level graph” and “sentencing factor substrings map” show an influence of substrings upon the sentencing. This engine is to graphically output the results of Sentencing Factors Analyzer and Sentence Estimator. After the interaction with the interface user is able to see the verdict margin for a given case, to manipulate parameters and see how they change this result. Detailed description of this part can be found in [3].

## 4 Sentencing Trend Information

### 4.1 Investigation Data

For examining information trends on sentencing there is a need to collect precedent data gathered in year units as shorter period data would not be enough to show changes. For this research we manage to collect precedents data from 1998-2001 newspapers articles and freely available online cases data for years 2001-2007 which gave us precedents covering about 10 years period. Then we limited the data to murder cases mainly for two reasons – because they are very often widely described by mass-media and because the new lay judge system will be applied only to heavy criminal cases such as homicide. We retrieved articles on murder cases from Mainichi Shimbun Corpus by following steps. First, we queried 1998-2001 data for “murder”, “imprisonment” and “was sentenced” using AND search which gave us 510 hits. Because there are many cases when several articles describe one case, we excluded those which contained the same suspect name. After applying this filter, 284 articles left. Among Mainichi Shimbun Corpus tags there are “editorial article” and “commentary article” section tags. Five editorial and three commentary articles were also excluded from our data. For sake of our investigation we also decided to limit cases to sentences of imprisonment for a definite term - 15 “not guilty” cases, 91 “life imprisonment” cases and 12 “death penalties” were excluded, too. During the final manual check three the same cases and one foreign court case were found and filtered out as well as five

cases with several accused persons - it would be rather hard to agree on factors influencing a verdict. Finally we had 149 articles. The next step was to automatically retrieve numbers of years of imprisonment (\*\* years of imprisonment) and names of suspects (suspect \*). Five of the retrieval results needed manual correction. Precedents data we obtained from the Supreme Court homepage<sup>2</sup> by using their external search engine queried for “homicide” AND “district court” as the new lay judge system will be applied only to district courts. By using such searching conditions we found 531 precedents. The data is written only in natural language - the text does not contain any tags on crime particulars as well as on verdicts. Because these precedents are saved in pdf format we had to excluded three documents which failed while converting to text. Then we used the same filtering rules as for newspapers articles excluding 110 cases from civil court, 44 cases with more than one suspects, 66 of non-homicide, 113 life-sentences, 33 death penalties, and 5 pled innocent cases giving a final number of 160 precedents. After searching for “\*\* years of imprisonment” the results needed no further manual correction. As we use data on longer period of time there was no need to set very grained date information so we arranged data dividing it into three months units. In case of newspaper articles sometimes the date of sentencing was not the date of issuing the newspaper including retrieved article. However, we thought that if divided into three months units, the differences would not be significant and would not influence the results much, therefore we used issuing dates for the time line-up tags.

## 4.2 Clustering The Cases

Figure 2 shows average assessments retrieved from articles and precedents in three months units. The regression line shows the total trend and one can observe that there was increasing tendency for murder cases during the investigated period. In fact, Japan was criticized for too light sentences for murder cases and the lower limit of 3 years of imprisonment was changed in 2004 to 5 years of imprisonment. This fact ensured us that the data we have prepared is enough for appropriate sentencing factors analysis. When considering a murder case, important factors are for instance the number of victims, murderer’s age or previous convictions existence and they play relatively important role when it comes to investigating differences between verdicts. As we mentioned in Section 3, our goal is to show how the sentencing changes when these factors vary. This is because a lay judge discussing a verdict needs to know what aspects can change it even for the same murder case. For this reason we decided to use CLUTO<sup>3</sup>[11, 12, 13] to cluster newspaper articles

<sup>2</sup><http://www.courts.go.jp/>

<sup>3</sup><http://glaros.dtc.umn.edu/gkhome/views/cluto>

**Table 2. Nagayama Criteria**

#1 Character of crime
#2 Motive of crime
#3 Crime method (esp. obstinacy and cruelty)
#4 Seriousness of crime result (esp. the number of victims)
#5 Bereaved family’s feelings
#6 Influence on society
#7 Age of criminal
#8 Previous offense
#9 Circumstances after the crime

and precedents data in order to examine the relations between the factors and the assessment of culpability.

There are so called Nagayama Criteria which are used when deciding the death penalty in Japan and we decided to utilize them as we needed features for CLUTO which would be convincing - also for a lay judge who wants to see what factors play the key role. Nagayama Criteria, as shown in Table 2, consist of nine decisive factors presented by Supreme Court in 1983 after famous trial of Norio Nagayama who was sentenced to death for killing four people in a shooting spree in 1968 at age 19. Later these standards became death sentencing guidelines for Japanese courts. However, as one can observe reading Table 2, Nagayama Criteria includes subjective judgements which are understandable for a human but very hard to be processed by a machine. As it is very difficult to decide what factors are appropriate for machine processing, we chose a very rough method of assuming that all the compound nouns in related newspaper articles and precedents data influence the assessment of the culpability. We used tf-idf to weight the compound nouns according to their occurrences and the results were utilized as features for CLUTO which classified whole data without distinction on newspaper articles and precedents data. For the morphological analysis we used ChaSen<sup>4</sup> and CLUTO parameteres were set to CL-Method=RB, CRfun=I2 and SimFun=Cosine.

## 4.3 Results of Analysis

We performed data clustering described in Section 4.2. Zero on Terms of Imprisonment axis means that there was no cases for a specified period of time. The year 2001 became a borderline between cluster groups 1-2 and 3-5. We decided to use divided data because, even when input together, the style differences between newspaper articles until 2001 and precedent data after 2001 heavily influenced the clustering process. While clustering with CLUTO there is a possibility to output Descriptive and Discriminating features and we made considerations based on these features. Descriptive features included words which most likely

<sup>4</sup><http://chasen-legacy.sourceforge.jp/>

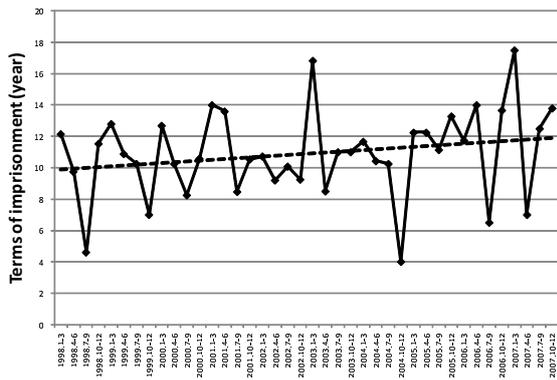


Figure 2. Transition of Murder Cases Sentences

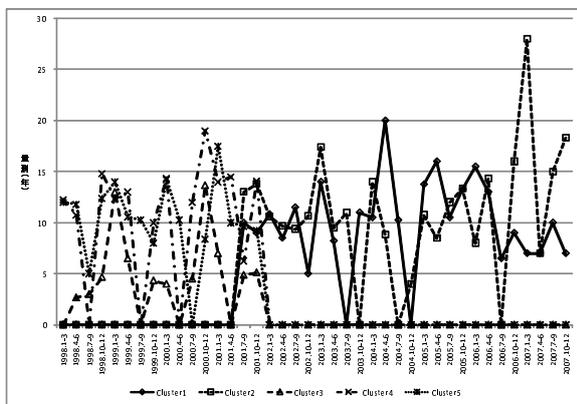


Figure 3. Sentence Transition

belong to No. 3 (Crime method) in Figure 2 such as "strangulation", "arson", "cut off" or lethal weapons as "rifle", "knife", or "rope", etc. However, most of the Descriptive features appeared to be proper nouns for names or organizations on the one side and non-independent nouns as *koto* or *mono* (thing). In future we plan to perform preprocessing of features as it is probably possible by utilizing results of morphological analysis and proper nouns extractors. We also found words like "victim" and "defendant". The former is characteristic for newspapers while the latter is typical to precedents texts and never seen in newspapers articles. This kind of differences in writing style between both sources are not favorable as factors for estimating murder case sentences and this is why we decided to divide our collected data into two sets.

## 5 Sentence Estimation Experiment

We used features mentioned in Section 4.2 and performed experiments to examine how accurate our method is in estimating sentences. Except of investigating the degree of how the features from Section 4.2 influence the estimation, we also checked efficiency

of the baseline for our Estimator System introduced in Section 3.2. Features used for sentence estimation were the same tf-idf-weighted compound nouns used for CLUTO. As was introduced in Section 3, we aim at specifying clearly what factors influenced the estimation together with the approximation result. It became important to estimate the sentence with a method where the factors influence degree is clearly understandable. To achieve this we first excluded inadequate features using a method described in the next subsection, and then performed the sentence estimation.

### 5.1 Filtering Out Inadequate Factors

As already mentioned in Section 4.3, there were improper factors for the assessment of the culpability and there was a possibility that they will harmfully influence the estimation process. Therefore we created a method that can automatically decide if a feature is adequate or not. We began with an assumption that there is no influence on estimation when all the features are mutually independent and then combined. Next, we defined a cases collection  $E_f$  which includes feature  $f$  and all cases collection  $E_n$  which does not include feature  $f$ . Average values of retrieved verdicts for collections  $E_f$  and  $E_n$  were defined as  $P_{E_f}$  and  $P_{E_n}$ . As we aim at automatic distinction, we used values of data before the manual corrections. It was decided for a feature  $f$  to be inadequate for an estimation when absolute value of the difference between average sentences  $P_{E_f}$  and  $P_{E_n}$  did not reach threshold  $T_{rel}$ . In this research we set the threshold  $T_{rel}$  for three years.

### 5.2 Choosing Related Cases

Let us assume there is case  $X$  and features  $x_1, x_2, \dots, x_n$  exist. First, for creating a simple method for estimating sentences we set up a condition that estimation  $P_X$  can be done for case  $X$  by only one feature  $x_1$  as well as the rest of features  $x_2, x_3, \dots, x_n$ . Then we gather a cases collection  $Y_1, Y_2, \dots, Y_m$  which have at least one identical feature from  $x_1, x_2, \dots, x_n$  and estimate sentence  $P_X$  from verdicts  $P_{Y_1}, P_{Y_2}, \dots, P_{Y_m}$  retrieved from every case. Naturally differences between sentences  $P_{Y_1}, P_{Y_2}, \dots, P_{Y_m}$  exist and there is a need for deciding which value should be regarded as important. Therefore we calculate similarity between cases by using cosine distance using every feature of a case as a vector and decided not to use cases which similarity with case  $X$  is lower than threshold  $T_{sim}$ . In this research we temporarily set threshold  $T_{sim}$  to 0.0005. Strictly speaking, it is possible that there are features inadequate for estimation and still calculated by similarity as adequate and opposite, but in this research we temporarily decided to treat all not similar features as inadequate for estimation.

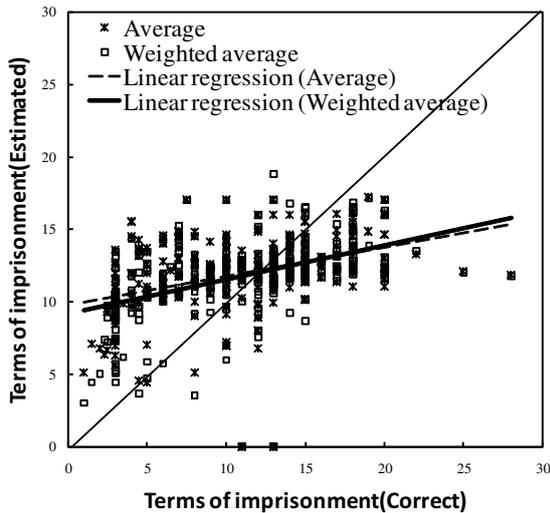


Figure 4. Relation Between Retrieved Sentences and Estimated Sentences

### 5.3 Verdict Estimation

There are few possible methods for estimating sentence  $P_X$  for case  $X$  from related cases sentences  $P_{Y_1}, P_{Y_2}, \dots, P_{Y_m}$ . We performed the estimation using two methods. The first one, called hereafter "Average", calculates the average value of  $P_{Y_1}, P_{Y_2}, \dots, P_{Y_m}$  and became our baseline method. The second one, called hereafter "Weighted Average", is our proposed method and considers similarity. The higher similarity between cases is discovered, the closer to the retrieved sentences estimation becomes - see equation 1.

$$P_X = \frac{\sum_{i=1}^m (P_{Y_i} \times S_{Y_i})}{\sum_{i=1}^m S_{Y_i}} \quad (1)$$

Here  $S_{Y_i}$  means the similarity between cases  $X$  and  $Y_i$ .

### 5.4 Results and Considerations

As introduced in Section 1 we assume that the final decision on sentence will belong to a user and we treat our proposed system as a support which can be allowed to have some (few years) margin for errors and we do not think such errors will be problematic. There is no need to give exact values of past cases sentences and we evaluated the system examining how big the margin for errors would be - how the estimation would differ from the real data. We calculated an absolute value for the difference between estimated sentences and all retrieved data filtered manually (treated as correct), then set their average value as the error margin. As the result, the baseline method achieved

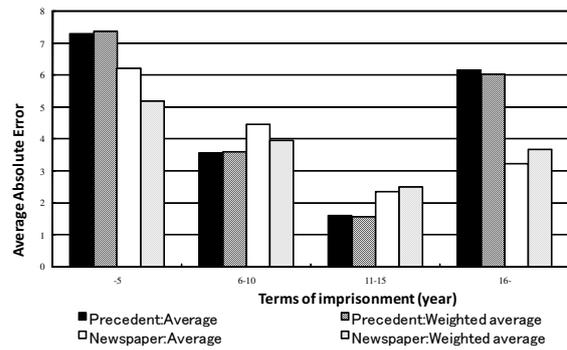


Figure 5. Comparison Between Precedents and Newspaper Articles

3.87 years error margin, while our proposed system using weights had 3.75 years. The difference is not that significant but we managed to prove the efficiency of using similarity described in Section 5.1. However, 3.75 years of margin gives more than 7 years in total which is quite big difference and surely needs improvement. Figure 4 is a scatterplot graph with X axis indicating retrieved sentences which were manually filtered and estimated sentences on the Y axis – "■" indicates cases estimated with Weighted Average Method and "※" with Average Method. The closer is the regression line to  $y = x$ , the estimation error is smaller and one can observe that Weighted Average has a slightly smaller error margin than Average. It is also observable that estimation is relatively more efficient for Weighted Average when there are retrieved cases with sentences below five years. Figure 5 shows average error margin for every case when divided into newspaper articles and precedents data. They are also grouped in five years intervals according to retrieved estimations for every case. When analysing the whole set, there are only few cases where the retrieved sentence was about 10 years and on the other hand there are many cases with verdicts under five years and above sixteen years. When the precedents are used there is no significant difference between results of Average and Weighted Average methods, while there is relatively big difference when using newspaper articles. The error margin decreases if Weighted Average Method is used on cases with verdicts smaller than 10 years and also decreases if Average method is used on cases with verdicts higher than 11 years. For this reason it is impossible to state that Weighted Average Method simply decreases the error margin and there is still room for further improvement. After examining cases of high similarity we understood that this is not always the case that the compared cases are actually similar and this also can cause harmful influence on the sentence estimation results. That is why we think there is need for a better similarity calculation in near

future.

## 6 Conclusion

In this paper we investigated trends in murder case verdicts and factors influencing sentencing process by using newspaper articles and precedents data. Then we examined results of sentence estimation based on clues which were words from the data texts. We obtained 149 newspaper articles from 1998-2001 and 160 available online precedents from 2001-2007 which were on murder cases and included verdicts. The results showed that there was increasing tendency for sentences in that period and by using CLUTO we clustered data into five classes which gave words describing crime methods or lethal weapons judged as descriptive features. However, writing style differences between articles and precedents had a big influence and many inadequate words were also input. Therefore we made further investigation and proposed automatic method for filtering out the inadequate features. After excluding them from data we performed estimation experiment using similarity. We discovered that weighting the similarity gives better results and proved that the proposed method decreased the error margin of estimation results. Nevertheless, the differences were not significant enough and we plan to improve the similarity calculation method to produce more accurate results and to avoid erroneous comparisons between cases.

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