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Implementation of Logistic Regression Algorithm for Complaint Text Classification in Indonesian Ministry of Marine and Fisheries

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Abstract:

Social media is usually used to express emotion in opinion or complaint statement regarding an object. In organization, this statement contained opinion and complaint to a service or program by it organization. This feedback can be used by organization to improve and enhance their quality. This research attempted to classify the reports from LAPOR! based on complaint and non-complaint using machine learning algorithm named Logistic regression (LR). This research completed through five research phases. The first phase is data collection, which is followed by crawling and labelling dataset, procession data, modelling dataset using Logistic Regression (LR), and evaluating classifier performance. As the result, the Logistic Regression model using Count Vectorizer feature extraction achieved better performance than Tfidf Vectorizer.

Keywords **— Indonesian text,marine and fisheries sciences, logistic regression, text classification**

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I. INTRODUCTION

Today, information and communication technology development *contribute to* the new application that support our daily life in many sectors, including cultural heritage [1], [2], government [3], [4], medical [5] and so forth. One of the current famous applications is social media that has been used by people for all range of ages. Social media is usually used to express emotion in opinion or complaint statement regarding an object [6]. The growth of text data contained opinion or complaint in social media indicated the importance of social media channels to campaign or publish about programs or services that is launched by governments or other organizations [7].

One of online aspiration in Indonesia based social media. The people's online aspiration and complaints services (LAPOR!) is a means of social media-based aspirations and compliants that are carried out with the principles of easy, integrated, and complete. LAPOR!'s site is managed and developed by the Ministry of State Apparatus Empowerment and Bureaucratic Reform with the Ministry of Home Affairs, the President's Staff Office, and the Republic of Indonesia Ombudsman as a channel for community participation for the supervision of development and public services in Indonesia.

Reports from people will be verified and forwarded to the authorized agency to be followed up. To manage the reports and accelerate the feedback, it required the application that can classify complaint and non-complaint report.

One of machine learning algorithms has been used in text classification is Logistic Regression. Logistic Regression can predict output or target in several categories. In this case, the algorithm will classify text data into two classes (1, -1), including complaint and non-complaint. Logistic regression

(LR) have been used to several problems in data mining and machine learning in which Logistic regression (LR) explained between response variable and predictor variables.

This research is focused to classify complaint and non-complaint reports from LAPOR!.This study implemented machine learning algorithm named Logistic regression (LR) for predicting the reports data.

II. LITERATURE REVIEW

Logistic Regression

Logistic Regression (LR) is the development of linear regression techniques for situations where outputs are categorical variables. Logistic Regression has been widely used in various data mining and machine learning problems where LR describes the response variables with one or more predictor variables [9].

In practice, situations involving categorical results are very common. In the case of sentiment analysis, for example, predictions can be made for positive, negative, or neutral outcomes. Like a linear regression method, logistic regression describes the predictor variable with its response variable. In logistic regression generally the response or target is dichotomous (consisting of two categories including 0 and 1), so it will follow the Bernoulli distribution with probabilistic functions as follows [9]:

$$f(y_i) = \pi(x_i)^{(y_i)}\left(1 - \pi(x_i)\right)^{(1-y_i)}$$

with $y_i = 0,1$, and for

$$\pi(x) = \frac{exp\left(\beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p\right)}{1 + exp\left(\beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p\right)}$$

The equation is then transformed by a logit transformation$\pi(x)$to get the function$g(x)$ which is linear in its parameters. So it is easier to predict the regression parameters, formulated as follows:

$$g(x) = ln\left[\frac{\pi(x)}{1 - \pi(x)}\right] = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p$$

Related Work

The recent works have been proposed Logistic regression (LR) algorithm to solve the research problems, e.g. Cheng and Eyke (2009), Rus et al. (2009), Freyberger et al. (2004), Feng and Back (2009), Kotsiantis et. al (2003), Mittal (2009) and Felix (2014).

Cheng and Eyke (2009) proposed the combination of Instance Based Learning and Logistic Regression to complete the multi-label classification [10]. Freyberger et al. (2004) proposed Logistic regression (LR) algorithm to find the best fitting of transfer model in case student learning data [11].

Rus et al. (2009) attempted to compare the result of data processing using several machine learning method for student mental model detection, e.g. Naïve Bayes, Bayes net, Support Vector Machines (SVM), Logistic Regression and Decision Trees [12].

Feng and Back (2009) proposed logistic regression for construction model of transfer in order to predict student can represent their knowledge [13]. Kotsiantiset. al (2003) attempted to classify student dropout prediciton by using Neural Network, Decision Tree, Naïve Bayes, Instance Based Learning, Logistic Regression, and Support Vector Machine (SVM) [14].

Mittal (2009) completed research about stock prediction based on twitter data using Linear Regression, Logistic Regression, SVM, and SOFNN [15]. Felix (2014) proposed classifier ensembls learning to increase accuration of *tweet sentiment analysis* [16]

III. METHODOLOGY

This research completed through five research phases. The first phase is data collection, which is followed by crawling and labelling dataset, procession data, modelling dataset using Logistic Regression (LR), and evaluating classifier performance.

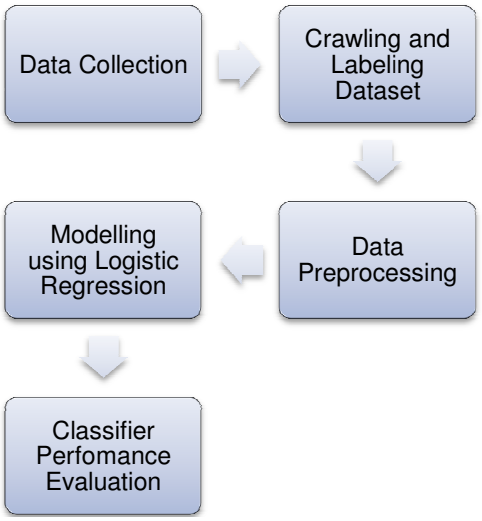


Fig.**Error! No sequence specified.** Research methodology

In first phase we collect dataset from twitter, and select text reports from Maritime categories. Then, we label the dataset based on tag label. The dataset are presented in Figure 1. In the second phase, the collected and labelled data is pre-processed to delete unimportant text data (*stop-word removal*), and then we conducted a feature extraction using TfidfVectorizer and CountVectorizer to be compare in modeling phase. In third phase, we model the data using training data, and then classified the testing data using this model. The last phase, we evaluated performance of classifier logistic regression for dataset with marine and fisheries domain.

1	Koperasi Mina Muara Tolis belum menerima Dokumen Kapal (pas besar) atas Bantuan Kapal yang diterimanya pada tahun 2016.
1	Penggunaan terumbu karang pada pekerjaan pengerasan jalan yang menggunakan Dana Desa (DD) tahun 2017 di Desa Banma
0	Mohon informasi alamat kantor Balai Besar Pengujian Penerapan Hasil Perikanan. Mohon informasinya, terima kasih
1	Tolong diproses untuk pembaruan ijazah laut di BP2IP Tangerang. Prosesnya lambat. 5 bulan tidak selesai. Kami tidak bisa beker
1	Paus terdampar di pantai tabuan Kab. Lombok Timur. mohon ditindak lanjuti. terima kasih Mohon ditindaklanjuti, terima kasih
0	APA ADA BANTUAN FIBER TAHUN 2018 Mohon ditindaklanjuti, terima kasih
1	Berada di Kabupaten Aceh Selatan, Propinsi Nanggroe Aceh Darussalam, setiap warung makan diwilayah ini menyajikan menu
1	Dg ini saya melaporkan bahwa : 1. Hingga hari ini tgl. 20.03.2018 kapal-kapal pengguna alat tangkap pukat hela (trowls) di lampu
1	Saya berharap ibu Susi Puji Astuti membantu nelayan di Desa Pesisir Rambat dan Tritip menengelamkan oknum-oknum yang me
1	Hampir di semua muara sungai di Kec, Sp Tritip. dan di Kec Mentok Kabupaten Bangka Barat banyak nelayan pantai menjaring u
1	MOHON DITERTIBKAN AKTIVITAS PENAMBANGAN TIMAH D ALUR SUNGAI BEROK KEC. BELINYU YG MERUSAK EKOSI
0	Permohonan informasi terkait pengurusan dokumen kapal bantuan untuk KSU Mina Muara Tolis. Mohon informasinya, terima kasi
1	Sekolah kami merupakan sebuah sekolah menengah kejuruan di bidang/jurusan agribisnis perikanan yang berada di salah satu
1	Adanya penangkapan ikan dengan menggunakan alat tangkap pukat hela (Trawl) di Perairan Lampung Timur Mohon ditindaklanj
1	Pengendalian Mutu, dan Keamanan Hasil Perikanan, Dengan hormat, surat terbuka ini kami tujukan kepada Ibu Mentri Susi yang
0	mohon informasi, terkait: 1. penggunaan Pukat 2. kami menunggu keputusan terkait penggunaan alat tangkap pukat 3. Kami dari
0	Slamat siang, langsung saja, bgaimana penerapan uu no 7/2017 dikarenakan ada diharmonisasi defenisi nelayan kecil antara uu

Fig. 1 Dataset

IV. EXPERIMENTS AND RESULTS

The stages in this research such as preprocessing, classification, validation and evaluation, are conducted in python programming language and scikit-learn library.

The preprocessing stage is done by removing stop words and extracting features using TfidfVectorizer and CountVectorizer, the feature extraction function in sklearn library. Classification in this stage is done using the Logistic Regression in sklearn library. The Validation in this stage is done using Cross Validation where the precentage of training sample 70% and testing sample 30%.

The feature that we extracted using TfidfVectorizer and CountVectorizerin previous step then we used them to compare the best model.

The performance evaluation results for Logistic Regression using TfidfVectorizer and CountVectorizer feature extraction are presented in Table 1.

Table.1 Research methodology

	Acc	F1 score	Precision	Recall	Kappa
Tfidf	0.9181	0.9181	0.9191	0.9181	0.8363
Count	0.9356	0.9355	0.9406	0.9356	0.8715

The result shows that Logistic Regression using CountVectorizer feature extraction achieved better performance than TfidfVectorizer feature extraction.

The precision, recall, and f1-score for each class using TfIdfVectorizer presented in Table 2:

Table.2 precision, recall, and f1-score for each class using TfIdfVectorizer

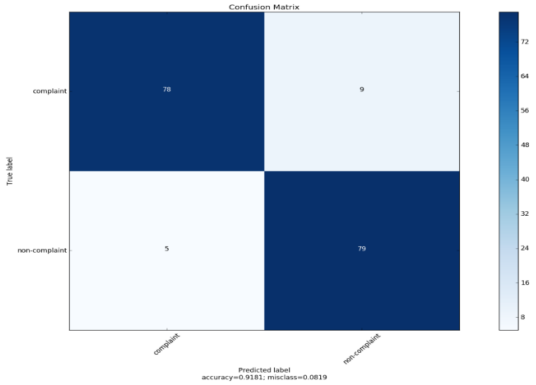
class	precision	recall	F1-score
0	0.94	0.90	0.92
1	0.90	0.94	0.92
average	0.92	0.92	0.92

The precision, recall, and f1-score for each class using Count Vectorizer presented in Table 3:

Table.3 precision, recall, and f1-score for each class using CountVectorizer

class	precision	recall	F1-score
0	0.99	0.89	0.93
1	0.89	0.99	0.94
average	0.94	0.94	0.92

The confusion matrix for the testing data using



TfidfVectorizer is presented in Figure 2.

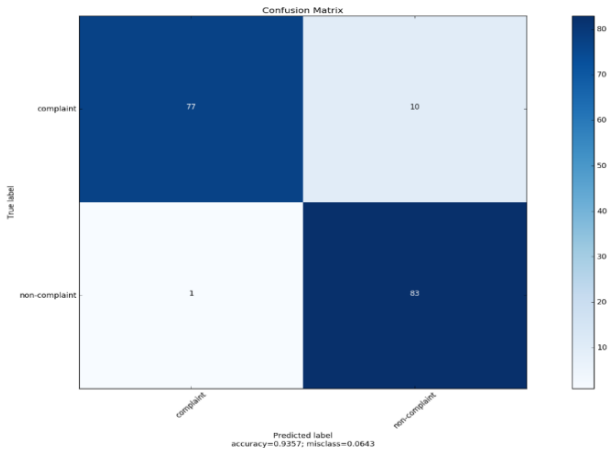


Fig. 2 Dataset

The confusion matrix for the testing data using CountVectorizer is presented in Figure 2.

V. CONCLUSION

This research attempted to classify the reports based on complaint and non-complaint using machine learning algorithm named Logistic regression (LR). This research completed through five phases. The first phase is data collection, which is followed by crawling and labelling dataset, pre-processing data include stop-word removal and feature extraction, modelling dataset using Logistic Regression (LR), and evaluating classifier performance. As the result, the Logistic Regression model using CountVectorizer feature extraction achieved better performance than TfidfVectorizer.

VI. ACKNOWLEDGMENT

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