International Journal of Informatics and Computation (IJICOM)
Vol. 3, No.1, Agustus 2021
ISSN: 2685-8711, E-ISSN: 2714-5263 DOI : 10.35842/ijicom

The Design Of Augmented Reality Media Koi Fish Literacy Using Fast Corner Algorithm

Muhamad Rofiudin[1], Nurhadi Wijaya[2], I Wayan Ordiyasa[3]

Abstract
Ornamental fish that are quite famous and in demand in the market is the koi fish. This fish has a relatively high economic value, and its demand is increasing. There are still many difficulties in maintaining this fish so that it can cause the growth of disease and even death in the fish. It is due to the lack of public attention in terms of literacy about koi fish. Researchers used augmented reality technology to design koi fish literacy media based on these problems using the FAST Corner algorithm. So it is hoped that it could help improve public literacy about koi fish by introducing real-time information. The Fast Corner detection algorithm is helpful to accelerate the computational time when detecting corners in real-time with the markerless Augmented Reality technique. In this technique, the marker used for object tracking has been replaced with pattern recognition or pattern recognition of an object. The study results showed that experiments using this algorithm could track targets with good and faster performance and a maximum level of accuracy.

Keywords:
Augmented Reality, Fast Corner, Literacy, Koi Fish

1. Introduction

Information technology research is boosting in various industry [33][34][35]. Indonesia is a significant and promising fish commodity, especially in the ornamental fish sector [1]. One of the most famous and in-demand ornamental fish in the market is koi fish [2]. This fish is prevalent and is a superior ornamental fish with an attractive body shape and color pattern. However, few people do not know the characteristics and detailed information about this type of fish [3].

Koi fish is one of the ornamental fish with a relatively high economic value [4], public interest in maintaining this fish is also increasing [5]. The quality and health of fish are one of the success factors of fish farming, but difficulties in maintaining this fish still occur so much that it can cause disease growth and even death in the fish. The keeper's understanding of the health of the fish must be ascertained so that things do not happen that are not desirable [6]. Koi fish are very susceptible to poor water quality, so their care must be considered to survive in excellent condition [7].

Along with advances in technological developments, the learning process, education, and daily activities cannot be separated from the use of information technology. Likewise, in the process of delivering information, various methods are used to carry out the process quickly and more attractively [8]. Introductory media such as reading books and searching for manual information on the internet are considered less attractive and tend to be boring. It causes a lack of public attention in terms of literacy about koi fish. With the change in educational media from traditional books to digital media, it will become more fun and an attraction for the wider community. Visual support will help the educational process to be more effective and exciting. One technique that can be done is by utilizing augmented reality technology [9]. The potential of augmented reality has considerable and interesting

Corresponding Author:
1 Muhamad Rofiudin[1], Universitas Respati Yogyakarta,
2 Nurhadi Wijaya[2], Universitas Respati Yogyakarta (nurhadi@respati.ac.id)
3 I Wayan Ordiyasa[3], Universitas Respati Yogyakarta (wayanordi@respati.ac.id)

value in facilitating media literacy so that it can increase insight, productivity and broaden people's views of the real world [10] [11] [12].

Based on the problems described, we need a way to help improve public literacy on koi fish by delivering information quickly or in real-time. This approach helps increase public interest in the literacy process by creating interactive and exciting models. Based on previous research, marker-based tracking was an augmented reality method that still used markers with black and white illustrations with thick black borders [13].

In this study, the development of the marker-based tracking method was proposed, so researchers intend to propose a new method by designing augmented reality technology for koi fish literacy media using the Fast Corner algorithm with the markerless method of augmented reality. In this method, markers used for tracking objects have been replaced with pattern recognition. The tracking process can use common images as markerless in recognizing objects such as images of plant animals and many more [14]. The model development is done to complete the work appropriately, quickly and facilitates information delivery.

Therefore, this research is expected to be a new potential to deal with the lack of public literacy regarding koi fish. The study conducted experiments using the Fast Corner algorithm to detect the angle of an object so that computational time can be done quickly when detecting angles on some koi fish objects. In further review, the objectives of this study are as follows:

1. The study introduces new designs and models for introducing information about koi fish using Augmented Reality technology by combining virtual objects and real objects in multimedia-based virtual form. This model is expected to attract public attention and interest in studying the characteristics of koi fish to improve people's literacy about koi fish.
2. We use the Fast corner algorithm to detect angles from images that will be used as markerless. It is done so that the process of detection and extraction of features can be done more quickly so that objects can appear in a short time. The model is also expected to help koi fish farmers introduce the broader community regarding the characteristics and information of this fish so that the process can be done quickly, practically, and easily understood.

Organization: The structure of this study is structured as follows: Chapter I describes the issues raised. Chapter II provides a review of related research journals. Chapter III describes the problem definition of this research. Chapter IV describes the preparation of experiments consisting of Fast Corner algorithms, markerless and augmented reality model designs, and Chapter V lays out the results in detail from this study. Then Chapter V concludes the Augmented Reality design on koi fish literacy using the Fast Corner algorithm.

2. Related Works

Currently, several articles have proposed various learning methods about literacy about an object, along with the times, technology is required to enter the field of education. An article introduced an interactive learning system with a 3D fish model using mobile augmented reality, as a result of which child interest increased fourfold compared to the system running [15]. Another article also contained the development of virtual reality technology for education about freshwater fish using the ADDIE methodology. Multimedia elements were used to provide attractiveness to users so that these applications had the effective new potential for use in the learning process. Augmented reality was used to display objects from scanned markers; in the following article, the study utilizes augmented reality for the introduction of aquatic animals with the marker-based tracking method, the

results of the marker distance test with the camera needed to read markers are between 8 – 77 cm [17].

A study discussing the usability analysis of augmented reality used the HEBULA application to introduce rare animals and plants in Indonesia using quantitative descriptive methods to test usability. The results showed that the application is worthy of learning media with a User Acceptance Test (UAT) percentage of 92.6% [18]. In addition, another paper discussed the evaluation of augmented reality plant &animal cells (APRAC) tools that aim to increase students' learning knowledge about the similarities and differences of animal and plant cells. The app used 2D content on material books, then overlaid interactive 3D content to users to support learning. The results showed that the integration of AR with material books supports student learning and can be utilized to promote interest in a subject [19]. Other research presented the use of augmented reality and image processing techniques for the detection of fish levers. Images taken using AR models were then processed in HSV surgery. The results showed that the introduced method could accurately group the sick parts [20].

The research in the next article discussed the medium of animal recognition learning for PAUD schools by utilizing Augmented Reality technology. It used Unity 3D to support animation, audio, and text as visual information with 3D objects. The method used was the FAST Corner Algorithm. This research aimed to provide detailed information about animals interactively so that it could attract students. The results presented that students could more easily understand the material and interact to gain better knowledge or education using this application [21]. Similar research also proposed the use of augmented reality for children's learning media. Quantitative descriptive methods provided the result that the use of augmented reality as an educational medium could support concrete understanding of an object and be able to attract the focus and attention of children [22]. Recent research discussed efforts to utilize augmented reality as an interactive learning material in early childhood. It aimed for the introduction of animals to know the environment and food of the animal in question. 91% of students and 83% of teachers are enthusiastic and interested in using this app to learn more effectively [23].

Based on the literature review above, the author proposed an introduction media with a new model to solve the lack of public literacy regarding koi fish species. This research used Augmented Reality technology with a Fast Corner algorithm to do the angle detection process faster. With this, it was expected that the model could help the community improve literacy about the characteristics and information of koi fish so that the process could be done quickly, practically, and easily understood, and not dull.

3. Proposed Method

This paper focused on the application of augmented reality as a public literacy medium regarding koi fish. The lack of public understanding of koi fish and the methods utilized still used traditional ways to make the basic idea in the making of this paper. With the enactment of our proposed methods, we hoped that people's literacy about this type of ornamental fish could be improved. So that in its maintenance, it was not difficult to meet the needs of fish. Thus the fish could live healthy and not diseased. We proposed an augmented reality model using the fast corner algorithm and markerless augmented reality technique. This algorithm was used as a feature extraction process on markerless objects.

In this paper, we presented a new model to improve people's literacy about koi fish by developing the model we used, the FAST Corner algorithm. FAST is one of the methods of image angle detection proposed by Edward Rosten et al. with a reasonable degree of precision from the extraction of the angle point [24]. The process of detecting the corners of an object is called corner detection. Corner detection in the FAST Corner algorithm is also known as point of interest detection. FAST is used to map and track objects at a very

high speed and detect feature points in real-time [25]. After it runs the algorithm, this algorithm determines the angle point by changing the image to black and white. The algorithm ensures corner points by selecting point p from the image to be processed [26].

The following is an explanation of the Fast Corner Detection algorithm based on Figure 1, i.e.:

1) Determining the point p at the initial position of the image (Xp, Yp).
2) Determining the four points around the point p in the initial position. The first point to the third point has different coordinates.
3) Comparing the intensity of the point in the center with point p and the other three points around it. Point p is the vertex or center. There are several cases in this determination, namely :

$$C = \begin{cases} In < Ip - t & \textit{(Dark)} \\ Ip - t < In < Ip + t & \textit{(Normal)} \\ Ip - t < In & \textit{(Bright)} \end{cases}$$

Information: ……..*(1)*

In = dot pixel intensities in the n

Ip = intensity of the center point

T = threshold

4) After that check the pixels whether it still exists or not. If there is, then proceed to the process of shifting point p to the next position (1+) to compare with the point around it.
5) Perform all repetitions until all points in the image have been detected in their entirety.

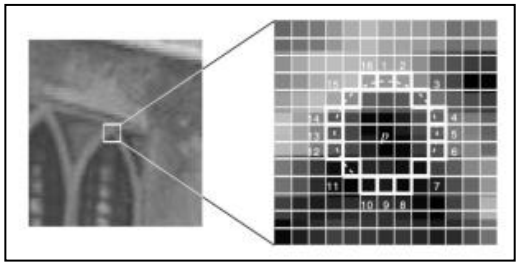

Fig. 1. Fast point detection

The FAST Corner algorithm is used to detect the angle of an object and extract various features in it. It is used so that computing time can be done quickly when real-time angle detection with a decreased rate of angle detection accuracy. In object recognition, this algorithm utilizes the brightness level in the markerless image object so that the system can recognize each angular point value on the object image with great precision. When this algorithm is used, marker detection will provide good precision from angle extraction and have efficient performance and high calculations.

4. Experimental Setup

1. Main Idea

   The basic idea of this study was to create a literacy model in the form of Augmented Reality as a medium of recognition of koi fish using the Fast Corner Algorithm. The underlying thing was the lack of public literacy in recognizing koi fish, so the proposed method was expected to solve the problem. The completion of the literacy model started from the tracking process in the form of markerless detection to produce information about the object to be studied. The detection of the angle of the process was done using a fast corner algorithm.

2. Dataset

   In this study, we proposed a technique using Markerless Augmented Reality. This method did not require a frame marker to display 2D objects. The use of markers has been changed by marking arbitrary images as objects to be tracked or tracking objects [26]. So we used a sample image of a koi fish object as a markerless material. Our object tracking and recognition process used the Fast Corner algorithm. Tracking by this algorithm was used to find the features of the markerless image object. When tracking was carried out, the system will calculate the position between the lens or camera on the device used by the user and objects in the real world. Markerless could be recognized in the form of the location and position of the device used.

   In this study, we collected several images of each type of koi fish. We used a sample image to be used as markerless consisting of 20 types of koi fish, namely goromo, ogon, kinginrin, goshiki, hariwake, hikarimono, sanke, matsuba, showa, tancho, shiroelemeni, hi utsuri, ki utsuri, koi slayer, chagoi, ochiba shigure, soragoi, kumonryu, shuisui, and kikokuryu.

3. Vuforia SDK

   Vuforia SDK is a software development kit for mobile devices that uses computer vision technology to track and recognize objects. In this approach, Vuforia converts images into markerless augmented reality and then measures markerless quality levels [27]. In this section, the developer allows configuring images in real-time and creating image targets according to the schematic, then providing virtual objects through the camera window [28].

   The study also used Google Collaboratory to find out angle tracking and feature detection on objects to be extracted [27]. The process of converting images to markerless was done by uploading images on the Vuforia developer web page. After that, the image will be converted. unity package format, which will be used as input to the Unity Engine to detect markerless images. Images to be made markerless must be in .jpg or .png format and file size <= 2 Mb. With grayscale or RGB colors and images, must-have features or angles. Vuforia SDK would explain how well markerless can be tracked with the FAST corner algorithm, which was described by a 1 to 5-star rating.

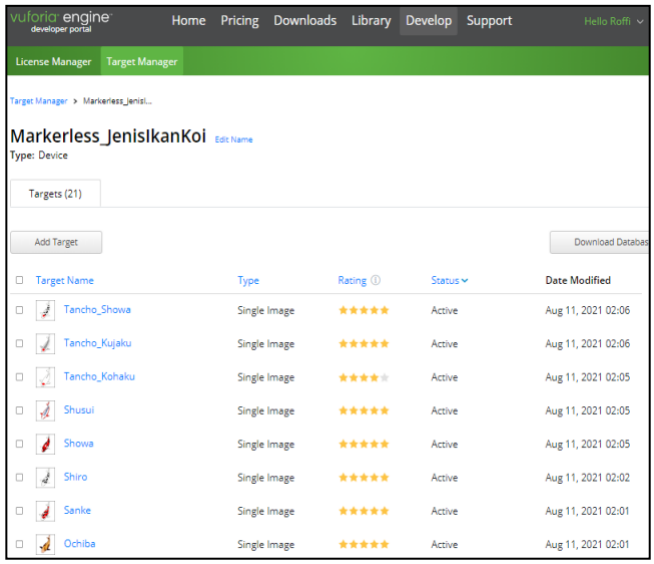

Fig. 1. Image database in Vuforia

4. Unity 3D

Unity is a game engine or multi-platform software designed to be easy to use and can be used for free. Using the C# programming language to develop applications [29]. By using Unity, developers make it possible to create 3D/2D games, develop augmented reality, online games, and many more. [30]. Its relatively fast development and deployment capabilities are the most popular features of this software [31]. In this study, Unity was used to build a model into an Android mobile application so that the program can run. The target image database that has been downloaded from the Vuforia page in the form of packages along with video model objects that will be displayed would be imported then imported to Unity 3D. In Unity 3D, we would process our project, which will later be uploaded and run on the Android platform.

5. AR Method

The first process carried out is by taking pictures from a smartphone camera on a markerless image. Then the system will preprocess the markerless image that has been inputted. After the markerless image was converted to grayscale, it entered the corner point feature extraction process using the FAST algorithm in the Vuforia library. The algorithm would determine the angle point p as the prefix and then the initialization process of other angular points around point p. The extraction of this vertex feature would produce a pattern (pattern recognition) which will be used in the following process. The system will match the corner point pattern with the database when the corner points have been extracted.

The Vuforia SDK function would take place to provide Augmented Reality functionality into smartphone devices. Thus, the processed photo data will appear with a 2D virtual design. When the pattern on the markerless image matches, the object in the form of a video will be displayed on the smartphone screen with a 2D virtual design.

5. Result & Analysis

In this experiment, testing is done to determine whether the program has functioned properly and there are no errors [16]. Hence, the results will provide inputs and outputs that follow expectations. Testing is done with the Blackbox testing method to see if any flaws or errors were found in the tested model. By doing the test, it will be known that the model has met the criteria by design made. The application page display can be seen in the following image:

Fig. 2. Object display when markerless detected

After going through the testing phase, the results show that the model made can function well, with the following details:

Function	Expectations	Observation	Result
The application model can normally run on an Android smartphone	It normally runs on an Android smartphone	The application model can run smoothly on android smartphones	Fulfilled
The application model can detect markerless and display a koi fish literacy video.	Able to detect all markerless made from each type of koi fish	The application model can detect all markerless of each type of koi fish made.	Fulfilled
The application model can display videos and play videos well	Able to show and play videos and pause koi fish literacy videos smoothly	The application model can display a koi fish literacy video on a scanned markerless and can play and pause well and smoothly	Fulfilled

Function	Expectations	Observation	Result
Markerless can be detected at a distance of 30 cm	Capable of detecting markerless at a distance of 30 cm	The application model can detect markerless at a distance of 30 cm	Fulfilled
User Friendly or easy to use the application model	Easy to use	The application model created is straightforward to use	Fulfilled
Videos that appear after markerless are detected can be run immediately	The video appears when the camera is pointed at the markerless, and the video can be run immediately	Markerless can be detected, and the video that appears can be run smoothly	Fulfilled

All the experiments carried out using the BlackBox method and running the Augmented Reality application showed that every part and function could run well as expected. As a result, this application model could be used. Objects could appear when the light in the room or the light that illuminates the markerless was bright enough. However, in low light conditions, markerless was a little difficult to detect.

6. Conclusion

After going through the model's design, implementation, and testing stages, it could be concluded that the koi fish recognition model using augmented reality technology could appear in the form of 2D video information and objects. Information could be accessed through the Android smartphone camera so that it was easy to access and could be used to introduce information to the public. Nevertheless, at the same time, the model could only display one literacy video from the detected markerless. The model created can help the community and new cultivators recognize in more detail the object in question and increase the community's attractiveness and literacy about koi fish. In future research, the visualization should be designed in 3D and video to display koi fish information.

Acknowledgment

This study is conducted under the Department of Informatics. Respati University of Yogyakarta, Indonesia.

References

[1] Sinasari, S, and B Priono, “Opportunity and Bussiness challenge of marine ornamental fishes in Indonesia as a potential commodity of fisheries," *International Conference on Green Agro-industry and Bioeconomy,* 2019.

[2] Yunikasari, R D *et al*., “Correlation between water quality and prevalence on Koi *(Cyprinus carpio),* which infested by *Argulus* in Mungkid Subdistrict and Muntilan Subdistrict, Magelang Regency, Central Java, *2nd," International Conference on Fisheries and Marine Science*, 2020.

[3] Laksono, M G *et al*., “Koi *(Cyprinus carpio)* Hatchery techniques: its performance in BBI Boyolali, *The 1st," International Conference on Biotechnology and Food Sciences,* 2021.

[4] Krismiyati *et al*., “Peripheral blood of koi fish (Cyprinus carpio) infected by argulus japonicus in Mungkid and Muntilan District, Magelang, Central Java,” *Indian Veterinary Journal,* 2019.

[5] Andriyani, Yuli, *et al*., “Performance of Lettuce and Water Spinach in Koi Fish-Based Aquaponics System,” *Asian Journal of Fisheries and Aquatic Research,* 2019.

[6] Yanuhar, U *et al*., “Response of kutuklin hemagglutinin protein adhesion in koi fish (Cyprinus carpio) infected by Myxobolus sp,” *2nd International Conference on Fisheries and Marine Science*, 2020.

[7] N, Putriana, Tjahjaningsih and Walamsjah M., “Effect of Red Pepper Juice (Capsicum annuum) in Feed on Koi Fish Color Brightness (Cyprinus carpio L.),” *Scientific Journal of Fisheries and Marine Affairs,* 2015.

[8] K. T. Martono and A. Fauzi, "Design of learning media for fish classification with augmented reality technology," *2017 4th International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE)*, pp. 270-275, 2017.

[9] Mahayuddin, Zainal Rasyid, and Najmiah Mamat., “Implementing Augmented Reality (AR) on Phonics-based Literacy among Children with Autism,” *International Journal on Advanced Science Engineering Information Technology,* Vol.9 No 6, 2019, ISSN: 2088-5334.

[10] Ilgu, Aliye Karabulut, *et al., “*Usability of a Mobile Augmented Reality Application to Teach Structural Analysis,” *American Society for Engineering Education,* 2018.

[11] Aziz, Faieza Abdul *et al., “*Using Marker Based Augmented Reality for Training in Automotive Industry,” *International Journal of Recent Technology and Engineering (IJRTE)*, Vol.7, Issue. 4S2, 2018, ISSN: 2277-3878.

[12] Indrawan, Wayan Andis, *et al., “*Markerless Augmented Reality Utilizing Gyroscope to Demonstrate the Position of Dewata Nawa Sanga,” International *Journal of Interactive Mobile Technologies,* Vol. 12, No. 1, 2018.

[13] Syihabudin, Bagas, *et al*., “The introduction of 3D applications Animal In Indonesia Using Augmented Reality Marker-Based Tracking Method,” *Jurnal Mantik,* Vol 3 No. 4, Feb. 2020, pp.33-41 E-ISSN 2685-4236.

[14] Widiaty, Isma, *et al., “*Implementation of Markerless Augmented Reality Method to Visualise Philosophy of Batik Based on Android,” *Pertanika Journal of Science and Technology.* 26 (3): 1383 – 1400, 2018.

[15] Oh, Yeon-Jae and Kim, Eung-Kon, “Implementation and Interest Analysis of 3D Fish Encyclopedia System for Early Childhood Education in Mobile Environment,” Journal of the Korea Electronics and Telecommunications Society, vol. 8, no. 2, pp. 355–361, Feb. 2013.

[16] Yusuf, Yus Amira Mohd, *et al., “*Mobile-based Virtual Reality Application for Freshwater Fish Education,” *International Journal of Engineering Trends and Technology*, Vol. 68 Issue 10, 93-99, October 2020 ISSN: 2231 – 5381.

[17] Haryanto, Edy Victor, *et al*., “Implementation of Augmented Reality of Android Based Animal Recognition using Marker Based Tracking Methods,” *1st International Conference of SNIKOM,* 2018.

[18] Darmawel, and P. Syifa, “Usability Analysis On The Endangered Indonesian Animals And Plants Augmented Reality Application,” *Jurnal TECHNO Nusa Mandiri,* Vol.17, N0.2 Sept. 2020.

[19] Kouzi, Malek El, *et al., "*Augmented Reality Plant & Animal Cells: Design and Evaluation of an Educational Augmented Reality Application," *Journal of Virtual Worlds Research,* Vol. 12 No. 3, ISSN: 1941-8477.

[20] Chakravorty, and Hitesh, "To Detection of Fish Disease using Augmented Reality and Image Processing," *Advances in Image and Video Processing*, Vol. 7 No. 6, December 2019, ISSN 2054-7412.

[21] Nainggolan, Esron Rikardo, *et al., "*The Implementation of Augmented Reality as Learning Media in Introducing Animals for Early," *The 6th International Conference on Cyber and IT Service Management*, 2018.

[22] Anggara, M R *et al., "*Utilization of augmented reality technology as a learning media for early childhood*," International Symposium on Materials and Electrical Engineering*, 2019.

[23] Kmurawak, Remuz MB, and D. Setyaningsih, "Use Of Augmented Reality As A Learning Media In Early Childhood," *Early Childhood Research Journal,* Vol 02 No. 1 June 2019, ISSN: 2655-9315.

[24] Xiong, Wenyi, *et al., "*Improved_FAST_corner-detection_method," *The Journal of Engineering, IET International Radar Conference*, 2018.

[25] Patil, and Chetan., "Interior Design Using Augmented Reality," *International Journal for Research Applied Science & Engineering Technology (IJRASET)*, Vol. 6 Issue III, March 2018, ISSN: 2321-9653.

[26] Andriyandi, Adi Putra, *et al.,* "Augmented reality using features accelerated segment test for learning tajweed," *TELKOMNIKA Telecommunication, Computing, Electronics and Control,* Vol. 18, No. 1, Feb. 2020, pp. 208-216*,* ISSN: 1693-6930.

[27] Anggara, Devi Willieam, *et al., "*Grayscale Image Enhancement for Enhancing Features Detection in Marker-less Augmented Reality Technology," *Journal of Theoretical and Applied Information Technology,* Vol.98. No 13*,* July 2020, E-ISSN: 1817-3195.

[28] Liu, Xinqi, *et al., "*Application Development with Augmented Reality Technique using Unity 3D and Vuforia," *International Journal of Applied Engineering Research*, Vol. 13, No. 21, 2018, ISSN 0973-4562, pp. 15068-15071.

[29] Desierto, Art Jake R, *et al., "*GoonAR: A Bilingual Children Storybook through Augmented Reality Technology Using Unity with Vuforia Framework," *International Journal of Advanced Trends in Computer Science and Engineering, Advanced Trends in Computer Science and Engineering,* Vol 9 No.3, May - June 2020, ISSN 2278-3091.

[30] Martil, N W *et al., "*Augmented Reality (AR) based application to introduce animals for children," *International Conference on Vocational Education and Technology* **(IConVET)**, 2019.

[31] Kounlaxay, Kalaphath, and S. K. Kim., "Design of Learning Media in Mixed Reality for Lao Education," *Computers, Materials & Continua CMC*, Vol.64 No.1, pp.161-180, 2020.

[32] Fikri, and Imaduddin., "Mobile Device-Based Navigation Application Using the Wikitude Platform for ITS Environmental Case Studies," *JURNAL TEKNIK ITS*, Vol. 5, No. 1, 2016, ISSN: 2337-3539.

[33] Wanda, P. and H. Jie. "DeepSentiment : Finding Malicious Sentiment in Online Social Network based on Dynamic Deep Learning.", 2019.

[34] Wijaya, Nurhadi. Evaluation of Naïve Bayes and Chi-Square performance for Classification of Occupancy House. International Journal of Informatics and Computation, [Sl], v. 1, n. 2, p. 46-54, Feb. 2020. ISSN 2714-5263

[35] Diqi, Mohammad, Muhdalifah, Mujastia., "Design and Building Javanese Script Classification in The State Museum of Sonobudoyo Yogyakarta," International Journal of Informatics and Computation, [Sl], v. 1, n. 2, p. 35-45, Feb. 2020. ISSN 2714-5263.