2021 Asian Conference on Innovation in Technology (ASIANCON)
Pune, India. Aug 28-29, 2021

Face Recognition in the Context of Website Authentication

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***Abstract*— In 1995, developers and programmers have begun focusing on developing websites and data protection. This came as a result of the increase and growth of many digital services such as e-shopping services, bank account management, e-mails, and many other services that require a high level of protection and security. As the penetration internet gowned it throws many challenges towards information protection. Hence the importance of providing protection and security for websites and users to protect their data and privacy, and bearing in mind that authentication is the first and basic step to protect and encrypt information sources, it also provides a safe environment for Internet users, which gives them comfort and security when dealing with these sites. The idea of our research aims for developing a security system that combines some recognition algorithms based on machine learning and deep learning techniques to verify the identity of each user (authentication) for the website and all the services associated with it. Thus, we can achieve the highest level of protection and security from the digital gaps that hackers may exploit. Therefore, the facial expression became the most important technique to identify hackers. The obtained results reveal that deep learning-based techniques for face recognition over a collected dataset are superior to conventional machine learning techniques.**

Keywords: Deep Learning, Face Detection, Features Extraction, Classification Algorithms, Website Authentication.

I. INTRODUCTION

The use of internet has increased several folds in last twenty-first century and has entered most aspects of life through electronic gadgets in commerce, communication, learning, and public services. With the increase in the use of the Internet, so have security concerns and the development of security methods for the Internet to protect it from breaches and to fortify sites, services and datasets in a way that is difficult for amateur or professional attackers to penetrate. Website security has become a security concern for researchers and website owners because the development of hacker's programs. Most researchers consider the authentication or user verification the first and basic step for protecting websites and their associated services. And a set of algorithms has been proposed for verifying users for their authentication, such as, (CAPTCHA) that differentiates human and a robot, security questions, e-mail recovery, mobile number, and guessing images. However, face recognition-based web authentication approach is one approach which is gaining popularity. Therefore, in this paper we investigate the face recognition-based approach to perform web authentication. Face recognition-based approach includes a sequence of tasks as can be seen in Figure 1.

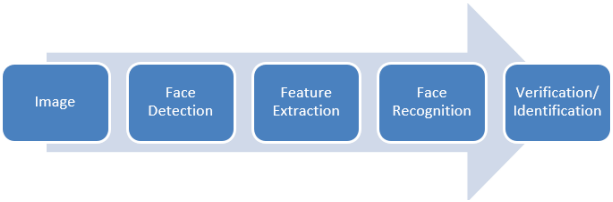


Fig. 1. Configuration of a general face recognition structure

Face recognition technique is one of the most important ways used for protecting websites. Face Recognition in the past consists of three main steps:

- Detection and recognition the faces by the camera: PCA algorithm it is a popular method for face detection and face recognition. However, the weakness in this algorithm is the large calculation.
- Feature extraction: The most of researches depended on [Principal Component Analysis] algorithm in feature extraction because it merges two essential steps (detection and recognition faces). However, the weakness in this algorithm is the large calculation.
- Classification Algorithms: After processing the images by using the previous algorithms, the results are entered into the classification algorithms as vector and from the most popular classification algorithms, the (decision tree). However, in our research, we developed an authentication method by deep learning to recognition face for website authentication.

This paper investigates face recognition with a recent feature of (InceptionV3) using some existing classification algorithms on publicly available dataset. The paper is structured as follows: section II includes basics information related to face detection, section III explains popular methods of feature extraction and, section IV lists out some widely used classification algorithms for face recognition. Results and discussion are presented in section V and finally in section VI some conclusions are withdrawn.

II. FACE DETECTION

Computer vision systems for conventional image data are not suitable because they include many elements. In this case, face detection becomes mandatory, and therefore an automatic face tracking system is required to develop, for example:

- Faces Covering: Among the most important examples of covered faces (glasses - beard - hands)

2021 Asian Conference on Innovation in Technology (ASIANCON) | 978-1-7281-8402-9/21/$31.00 ©2021 IEEE | DOI: 10.1109/ASIANCON51346.2021.9545027

- Features Coverage: The presence of items such as birds, glass, or hats.
- Face features: Facial features differ greatly due to different gestures, circumstances, and photography.

Face detection is largely depending on identifying geometric structure of the object as shown in Figure 2. Some approaches for face detection:

A. *Color images:*

It focuses on the three-color spaces. Which are RGM, YcbCr and HST. They make a comparison between these three famous skin colour detection algorithms and come up with a new algorithm depends on "skin colour classification" and show their results. After that, they present explanation of this three-color space [1].

B. *Images in motion:*

Real time video enables detection the faces [2].

III. Feature Extraction

Most people can recognize faces from the age of four years, so the process seems very easy. However, this topic is extremely complex as human can distinguish people who are known to them even when faces are in glasses, hats or in beard. This process sounds trivial but it poses a huge challenge for computers. Table 1 shows some of feature extraction methods to detect faces. PCA is famous algorithm see figure 2 applied it on face detection [3].

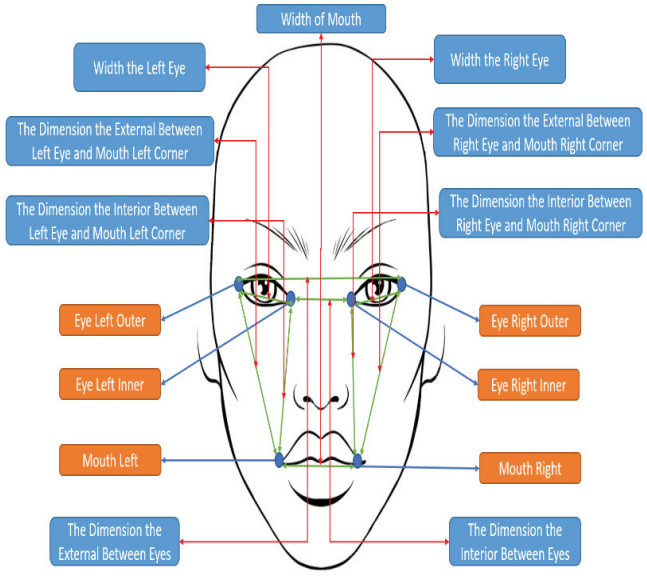


Fig. 2. Feature Extraction

IV. Face Recognition Algorithms

A. *Principal Component Analysis:*

It is the method used to analyze data. Restore the original data to the original data set, as well, and are used to reduce data for normal computation [4].

B. *Support Vector Machines:*

SVM is a learning algorithm and it is supervised learning, it used in classification problems for its effectiveness and for having an excellent basis in data. It is of two type's binary classification it categorizes only two groups and multi-class classification where it classifies more than one group [5].

C. *Independent Component Analysis:*

Here, they present a precise definition of ICA, and propose an algorithm, which depends on the integration length, and it is indeed guaranteed to reach the global maximum only in the case of two sources in the presence of non-Gaussian noise [6].

D. *Logistic Regression:*

This algorithm transforms the output using the sigmoid function to the Probability values, which will be categorized into one of the classes within this algorithm [7].

See table 1 for famous algorithms face recognition.

TABLE I. Face Recognition Algorithms

Algorithms Name
[PCA] Principal Component Analysis
Kernel [PCA]
[LDA] Linear Discriminant Analysis
Kernel [LDA]
Neural Network
[SOM] Self-organizing map
Gabor Wavelet

V. Results and Discussion

A. *Dataset:*

The dataset includes 13,668 pictures of 1409 persons, that is collected from internet resources such as https://www.kaggle.com/ and some volunteers' images were also included whose links are:

1. https://drive.google.com/drive/folders/1eYwC2otFyS8ksvEQg0OtY0lOrNbd412q?usp=sharing
2. https://drive.google.com/file/d/1_kl-JsGHCXBUhwx4MxRBT7sUMdP3BfnZ/view?usp=sharing

B. *Face detection:*

P. Viola & M. Jones is widely used for face detection because its ability to show high accuracy in detection therefore authors used this approach [8]. Figures 3 & 4 shows detected face using P. Viola method.

Fig. 3. Original Picture & Convert Picture to Gray Scale

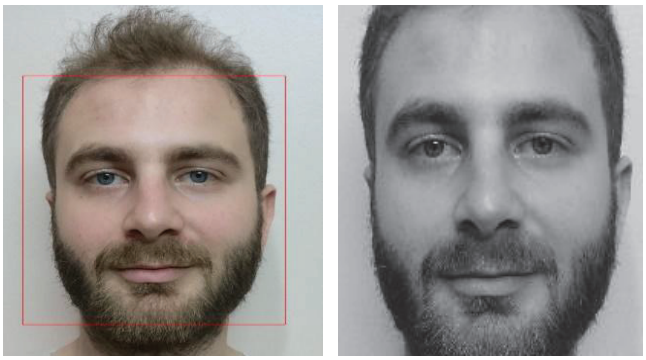
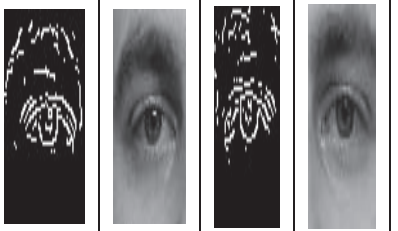
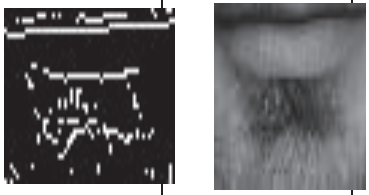
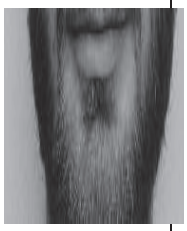


Fig. 4. Detected the Face & Extract the face from the picture

C. Feature Extraction

Firstly, we have to process the photo, then it will be cut into two parts, then the eyes and mouth will be converting to edges photos as the following one's table 2:

TABLE II. IMAGE PROCESSING

 Transforming eyes photos into bordered one after cutting these	 The upper part of the face
 Transforming of the bordered mouth photo	 The nether part of the face

After processing image, we will go to Facial landmark algorithm, P. Tome reached results best of algorithm PCA's results [3]. Landmark depends on points in the face show the points in figure 5. After that it is calculating the Euclidean distance between each point and the other to get a vector see table 3 and figure 6. Then these vectors are sent to the classifier's algorithm.

Fig. 5. The final algorithms output

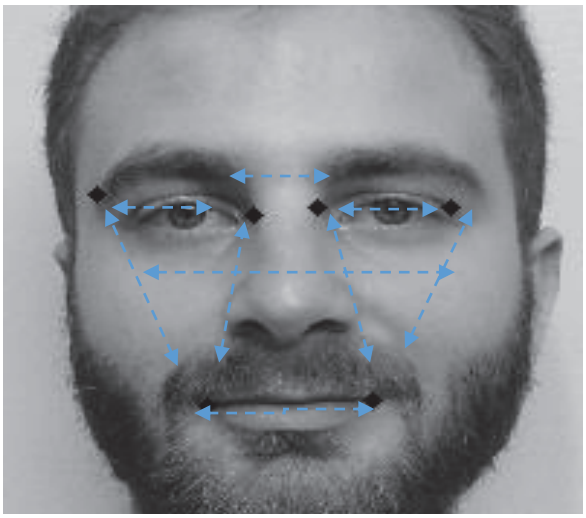


Fig. 6. The dimension of the face

Finally, the results will be vector that identify every face from the other. These vectors will be passed to the classifier see table 3.

TABLE III. LANDMARK ALGORITHMS RESULTS

Description	Distance
Width the Left Eye	46
Width the Right Eye	54.59
Width of Mouth	57.04
The Dimension the Interior Between Eyes	22.2
The Dimension the External Eyes	122.1
The Dimension the External Between Left Eye and Mouth Left Corner	113.95
The Dimension the Interior Between Left Eye and Mouth Left Corner	85.87
The Dimension the External Between Right Eye and Mouth Right Corner	124.2
The Dimension the Interior Between Right Eye and Mouth Right Corner	82.86

For that we used the InceptionV3 Algorithm [9]. It is Google's deep neural network for image recognition. It is trained on the ImageNet data set.

D. Classification for Face recongition

We used the famous algorithms for classification in face recognition case and the fowling chart there these algorithms with them results see chart 1:

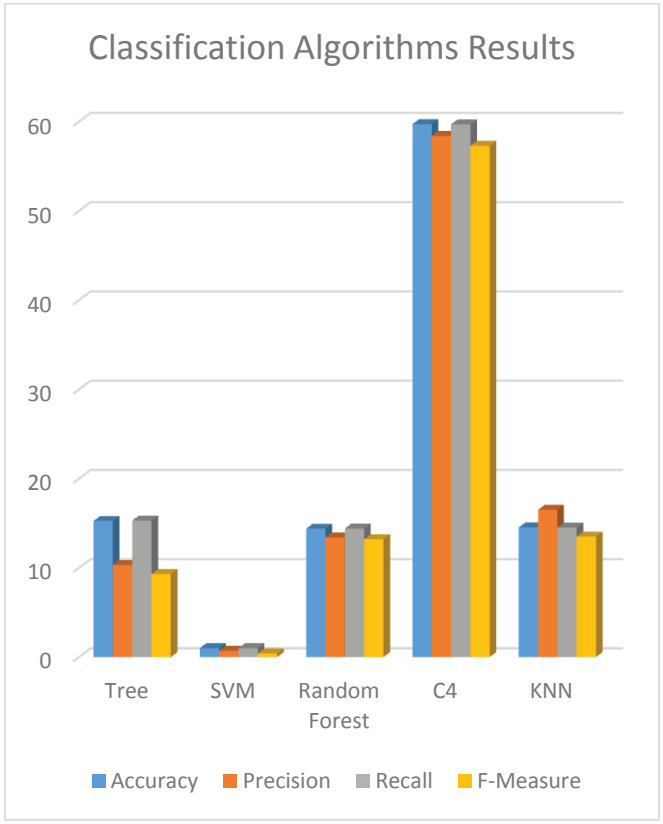


Chart 1 Algorithms Results (Old Methods)

For the embedding, we use the activations of the penultimate layer of the model, which represents images with vector [9]. After the training on our dataset we got 2,047 features for each picture see Figure 8.

For that we used the InceptionV3 Algorithm [9]. It is Google's deep neural network for image recognition. It is trained on the ImageNet data set see figure 7.

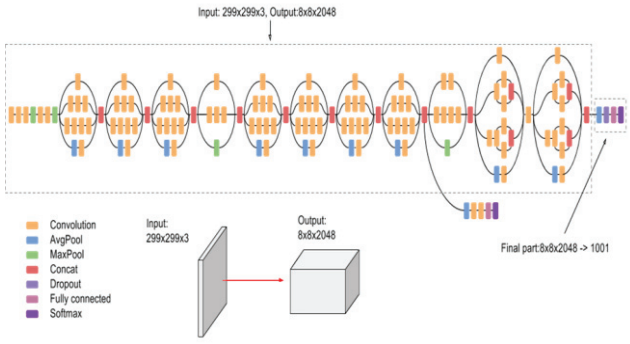
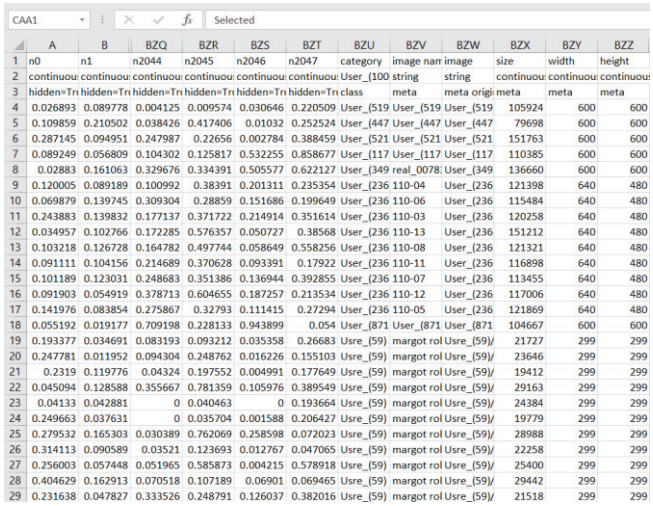


Fig. 7. Inception V3 Algorithm

(https://cloud.google.com/tpu/docs/images/inceptionv3onc--oview.png)



	A	B	BZQ	BZR	BZS	BZT	BZU	BZV	BZW	BZX	BZY	BZZ
1	n0	n1	n2044	n2045	n2046	n2047	category	image nam	image	size	width	height
2	continuou	continuou	continuou	continuou	continuou	continuou	User_(100	string	string	continuou	continuou	continuou
3	hidden=Tr	hidden=Tr	hidden=Tr	hidden=Tr	hidden=Tr	hidden=Tr	class	meta	meta origi	meta	meta	meta
4	0.026893	0.089778	0.004125	0.009574	0.030646	0.220509	User_(519	User_(519	User_(519	105924	600	600
5	0.109859	0.210502	0.038426	0.417406	0.01032	0.252524	User_(447	User_(447	User_(447	79698	600	600
6	0.287145	0.094951	0.247987	0.22656	0.002784	0.388459	User_(521	User_(521	User_(521	151763	600	600
7	0.089249	0.056809	0.104302	0.125817	0.532255	0.858677	User_(117	User_(117	User_(117	110385	600	600
8	0.02883	0.161063	0.329676	0.334391	0.505577	0.622127	User_(349	real_0078	User_(349	136660	600	600
9	0.120005	0.089189	0.100992	0.38391	0.201311	0.235354	User_(236	110-04	User_(236	121398	640	480
10	0.069879	0.139745	0.309304	0.28859	0.151686	0.199649	User_(236	110-06	User_(236	115484	640	480
11	0.243883	0.139832	0.177137	0.371722	0.214914	0.351614	User_(236	110-03	User_(236	120258	640	480
12	0.034957	0.102766	0.172285	0.576357	0.050727	0.38568	User_(236	110-13	User_(236	151212	640	480
13	0.103218	0.126728	0.164782	0.497744	0.058649	0.558256	User_(236	110-08	User_(236	121321	640	480
14	0.091111	0.104156	0.214689	0.370628	0.093391	0.17922	User_(236	110-11	User_(236	116898	640	480
15	0.101189	0.123031	0.248683	0.351386	0.136944	0.392855	User_(236	110-07	User_(236	113455	640	480
16	0.091903	0.054919	0.378713	0.604655	0.187257	0.213534	User_(236	110-12	User_(236	117006	640	480
17	0.141976	0.083854	0.275867	0.32793	0.111415	0.27294	User_(236	110-05	User_(236	121869	640	480
18	0.055192	0.019177	0.709198	0.228133	0.943899	0.054	User_(871	User_(871	User_(871	104667	600	600
19	0.193377	0.034691	0.083193	0.093212	0.035358	0.26683	Usre_(59)	margot rol	Usre_(59)/	21727	299	299
20	0.247781	0.011952	0.094304	0.248762	0.016226	0.155103	Usre_(59)	margot rol	Usre_(59)/	23646	299	299
21	0.2319	0.119776	0.04324	0.197552	0.004991	0.177649	Usre_(59)	margot rol	Usre_(59)/	19412	299	299
22	0.045094	0.128588	0.355667	0.781359	0.105976	0.389549	Usre_(59)	margot rol	Usre_(59)/	29163	299	299
23	0.04133	0.042881	0	0.040463	0	0.193664	Usre_(59)	margot rol	Usre_(59)/	24384	299	299
24	0.249663	0.037631	0	0.035704	0.001588	0.206427	Usre_(59)	margot rol	Usre_(59)/	19779	299	299
25	0.279532	0.165303	0.030389	0.762069	0.258598	0.072023	Usre_(59)	margot rol	Usre_(59)/	28988	299	299
26	0.314113	0.090589	0.03521	0.123693	0.012767	0.047065	Usre_(59)	margot rol	Usre_(59)/	22258	299	299
27	0.256003	0.057448	0.051965	0.585873	0.004215	0.578918	Usre_(59)	margot rol	Usre_(59)/	25400	299	299
28	0.404629	0.162913	0.070518	0.107189	0.06901	0.069465	Usre_(59)	margot rol	Usre_(59)/	29442	299	299
29	0.231638	0.047827	0.333526	0.248791	0.126037	0.382016	Usre_(59)	margot rol	Usre_(59)/	21518	299	299

Fig. 8. Features Using inception v3

We used widely known machine learning algorithms for classification in face recognition and results are obtained in terms of accuracy [10], see chart 2:

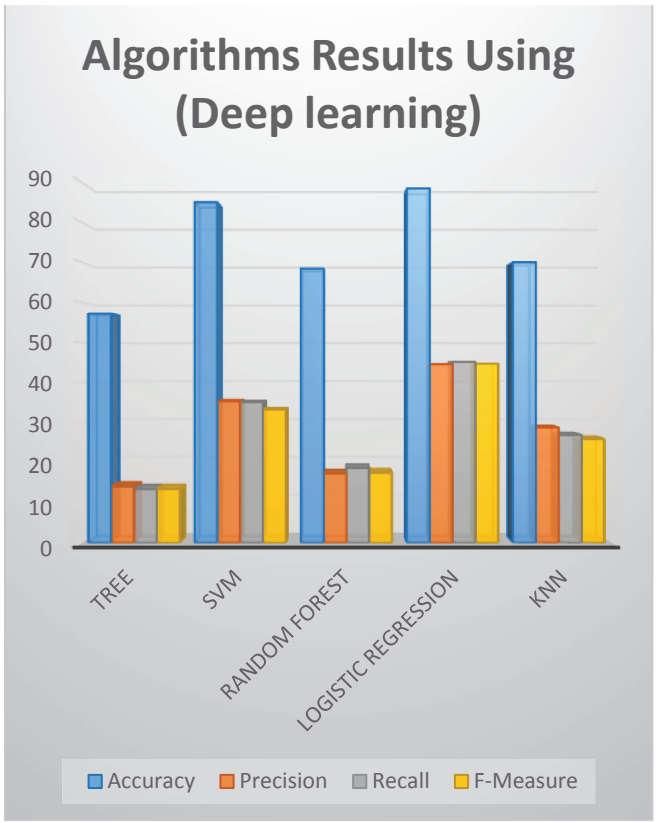


Chart 2 Algorithms Results Using (Deep learning)

VI. CONCLUSIONS

Face recognition methods were investigated aiming to use it for web authentication process. Some well known machine learning algorithms were used to on prepared datasets and later the obtained results were later compared with the deep learning based logistic regression. It was found that logistic regression performs better than traditional machine learning algorithms. The reported results are significant in face recognition based web authentication.

We intend to work towards improvement of the results as accuracy can be increased. In this direction, two major tasks will be taken in near future: first is to diversify and enhanced in-house dataset by inviting more volunteers, and second is investigating new deep learning architectures while tuning hyper parameters.

ACKNOWLEDGMENT

Authors like to express appreciation to the volunteers who contributed their face photos in dataset preparation.

REFERENCES

[1] Singh, Sanjay Kr.; Chauhan, D. S.; Vatsa, Mayank ; Singh, Richa"A Robust Skin Color Based Face Detection Algorithm," Tamkang Journal of Science and Engineering, vol. 6, no. 4, pp. 227-234, 2003.

[2] M. C. Nechyba, L. Brandy, and H. Schneiderman."Lecture Notes in Computer Science.," Springer Berlin Heidelberg, pp. 126-137, 2009.

[3] K. Pearson, "LIII. On lines and planes of closest fit to systems of points in space.," The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science, vol. pp. 2(11), pp. 559-572, 1901.

[4] Lu, Juwei ; Plataniotis, K. N. ; Venetsanopoulos, A. N. ; Z. Li, Stan, "Ensemble-Based Discriminant Learning With Boosting for Face Recognition," IEEE Transactions on Neural Networks, vol. 17, no. 1, pp. 166-178, 2006.

[5] Inukollu, V. N., Arsi, S., & Ravuri, S. R. "Security issues associated with big data in cloud computing," International Journal of Network Security & Its Applications, p. 45, 2014.

[6] Petrou, M. M., & Petrou, C."Image processing: the fundamentals," John Wiley & Sons, 2010.

[7] Zhou, C., Wang, L., Zhang, Q., & Wei, X."Face recognition based on PCA and logistic regression analysis," Optik, Vols. 125(20),, pp. 5916-5919, 2014.

[8] Nefian, Ara V.; Hayes, Monson H."HIDDEN MARKOV MODELS FOR FACE RECOGNITION," in Proceedings of the 1998 IEEE International Conference on Acoustics, Speech and Signal Processing, ICASSP '98 (Cat. No.98CH36181), Seattle, WA, USA, USA, 1998.

[9] Szegedy, C., Vanhoucke, V., Ioffe, S., Shlens, J., & Wojna, Z." Rethinking the inception architecture for computer vision.," In Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 2818-2826, 2016.

[10] J. Schmidhuber, "Deep learning in neural networks: An overview.," Neural networks, vol. 61, pp. 85-117, 2015.