Single Shot Multi-box Detector Algorithm Over Fast R-CNN: An Ingenious Technique for Increasing Object Detection Classification Accuracy

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ABSTRACT
Aim: The objective of this research paper is to employ the classification of object detection with improved accuracy rate by using Innovative Single Shot MultiBox Detector (SSD) in comparison with Fast R-CNN Classifier. **Materials & Methods:** The data set in this paper utilizes the publicly available Kaggle data set for object detection and classification. The sample size of classification of object detection with improved accuracy rate was sample 80 (Group 1=40 and Group 2 =40) and calculation is performed utilizing G-power 0.8 with alpha and beta qualities are 0.05, 0.2 with a confidence interval at 95%. Classification of object detection with improved accuracy rate is performed by novel Single Shot MultiBox Detector (SSD) whereas number of samples (N=10) and Fast R-CNN where number of samples (N=10). **Results:** The Single Shot MultiBox Detector (SSD) classifier has 96.81% higher accuracy rates when compared to the accuracy rate of Fast R-CNN is 94.44%. The study has a significance value of $p<0.05$ i.e. $p=0.0256$. **Conclusion:** The novel Single Shot MultiBox Detector (SSD) provides better outcomes in accuracy rate when compared to Fast R-CNN for classification of object detection.
Keywords: Object detection, Novel Single Shot MultiBox Detector (SSD), Fast R-CNN, Accuracy rate, Segmentation, Image pre-processing.

INTRODUCTION

Object recognition is an essential area for exploration in the image processing field. More recently, various statistics from the convolutional neural network (CNN) have been used in object recognition activities, and spatial accuracy and ability have been successfully improved (He et al. 2015), fast R-CNN (Girshick 2015), faster RCNN (Ren et al. 2017) and R-FCN emerged in the object detection area. However, recognizing an object at various levels is still a difficult task to test. This paper proposes a novel Single Shot MultiBox Detector (SSD) algorithm to build its characterization precision without influencing its speed (Tithi, Ali, and Azrof 2021). The exactness in distinguishing the object is analyzed by the various boundaries like mean normal accuracy (mAP), loss function and frames per second (FPS). The experiment outcomes show that the developed SSD strategy has accomplished high precision contrasted with the regular detectors (Wang, Wang, and Zhang 2018). The primary benefit of utilizing a novel Single Shot Multibox Detector (SSD) is that, not like different strategies, it very well may be utilized in workstations and other individual devices.

IRecently, many target detection methods have been proposed to tackle the issue of poor precision in the literature. IEEE Explore distributed 75 exploration papers, and Google Scholar tracked down 93 articles. Kumar et al. (Kumar, Ghrera, and Tyagi 2017) suggested a pivot invariant faster R-CNN target location calculation. By adding regularization requirements to the objective capacity of the method, the invariance of the objective CNN feature is upgraded and enriched the precision by 2.5%. Wei Xiang et al. (Xiang et al. 2018) concentration on the novel Single Shot Multibox Detector (SSD) which is measured as the most up to date calculation for recognizing the target. Nashwan Adnan Othman et al. (Othman and Aydin 2018) suggested OpenCV libraries and deep learning methods for acknowledgment for ongoing video and object discovery. Reagan L. Galvez et al. (Galvez et al. 2018) have revealed that order and identification of items is presently precisely conceivable with the new headways in the field of profound brain networks in picture handling. The authors have utilized CNN to recognize the items in the live location (Alamsyah and Fachrurrozi 2019). Yields plainly show that the

del is great for applications progressively, the explanation being its speed. Hui Eun Kim et al. zero in on information increase explicit to a specific area. There is exceptional development shown by utilizing the proposed technique which is specific to on street location of items and it updates the precision by 32%. Maria Jones and (Viola and Jones 2001) recommended that vital picture is the new picture portrayal, which permits the locator to recognize the items quicker. AdaBoost model from a bigger dataset picks least elements and gives very effective classifiers. Chengcheng Ning et al. (Liu et al. 2016) dedicated the novel Single Shot Multibox Detector (SSD) as perhaps the quickest calculation in the field of target recognition. It utilizes only one convolutional neural network for distinguishing the target in a image.(Bhavikatti et al. 2021; Karobari et al. 2021; Shanmugam et al. 2021; Sawant et al. 2021; Muthukrishnan 2021; Preethi et al. 2021; Karthigadevi et al. 2021; Bhanu Teja et al. 2021; Veerasimman et al. 2021; Baskar et al. 2021)

The major drawback with the fast R-CNN method is that the element extraction is complicated and the estimation process is very slow. It is hard to fulfill the requirements of continuous identification on a complicated and enormous dataset. This study proposes a completely robotic strategy for target discovery utilizing the Single Shot Multibox Detector (SSD) method in comparison with the fast R-CNN (FRCNN) calculation. The experimental analysis of the proposed Single Shot Multibox Detector (SSD) algorithm gives superior results than the conventional fast R-CNN method.

MATERIALS AND METHODS

This work was completed in the Digital Image Processing Laboratory, Department of Computer Science and Engineering, Saveetha School of Engineering. In this paper, the dataset is collected from the PASCAL VOC2008 database. The PASCAL VOC2008 dataset is a challenge of world level computer vision technologies. Two groups are taken and 20 samples for each group, total samples considered are 40. The database is divided by the amount of 75% training and 25% testing. Group 1 was a fast R-CNN algorithm and Group 2 was a novel Single Shot Multibox Detector (SSD) algorithm. Tests are simulated in the MATLAB software tool. The calculation is implemented utilizing G-power 0.8 with alpha and beta qualities 0.05, 0.2 with a confidence interval at 95%

Faster R-CNN

Faster R-CNN is one of the most exemplary methods in the field of target recognition. Faster R-CNN can tackle the issue that Fast RCNN utilizes the outsider instrument specific search to separate the district proposition. It utilizes RPN rather than specific search to make the whole objective location function into a bound together organization. It fundamentally comprises two sections.

Convolution layers: It is basically made out of the fundamental convolution, relu, and pooling layers, which are utilized to remove the component map in the picture. Utilized for later shared RPN layers and completely associated layers.

Region proposition organizations (RPN): RPN widely used to create locale recommendations. Use softmax to arrange the applicant box (whether the background picture is normal or abnormal), and utilize the bouncing box to perform a relapse amendment on the competitor box to get the recommendations.

RoI pooling: Collect component guides and recommendations, separate the proposition highlight map and send it to the resulting completely associated layer to decide the objective class.

Characterization: Use the proposition include guide to ascertain the proposition class, and bbox relapse again to acquire a more precise situation.

The Fast R-CNN technique resolves a few disadvantages of R-CNN to assemble a quicker object recognition method since it is called Fast R-CNN. Also, the methodology is like the R-CNN calculation. However, this calculation doesn't initially create region recommendations. The information data is taken care of as a contribution to the CNN to create a convolutional highlight map. From the RoI feature vector, softmax layer is utilize to expect the class of the location and besides refine the offset values for the bounding box including the below steps.

- Downloading the dataset to load
- Initialize the variables to train and test the data.
- Define a model. fit () function to describe the components which are to be accessed for running the code to get accuracy
- Define Categorical () function to categorize the data.
- Print the model. fit () function with the required epochs and find the accuracy

Single Shot Multibox Detector (SSD)

The Single Shot MultiBox Detector (SSD) is a deep learning model used to distinguish objects in a picture or from a video source. The SSD is a straightforward way to tackle the issue yet it is extremely compelling till now. The SSD has two parts namely Backbone Model and the SSD Head. Generally, the completely associated order layer is taken out from the model. SSD Head is one additional arrangement of convolutional layers included to the backbone model and the results are deciphered as the jumping boxes and modules of targets in the spatial area of the last layer's actuations.

To really look at the advantages of using this consolidated form and do a sensible assessment with other condition-of-craftsmanship models (VGG based SSD, YOLO) have fostered this joint rendition. The feature of novel Single Shot Multibox Detector (SSD) is gigantic and a long way from this undertaking have a short preface to how it capacities in the going with parts. For the most part, SSD involves different component layers as classifiers, in which a bunch of various viewpoint proportions as default boxes at each spot a convolutional way is utilized to assess each element map. Additionally, every model expects the class scores and shape equalizer score regarding the cases. At the hour of preparation, the accuracy in anticipating the default confines is considered provided that its jaccard cross-over with the ground truth box has an edge score of more than 0.6. Remaining scores that don't fall under the anticipated classification are then registered utilizing certain scores and furthermore limitation scores. At last, it is clear that carrying out the SSD system functions admirably in preparing the picture totally as opposed to relying upon the reference outline and including the accompanying stages.

- Given input as an image/Video then it reads the input and extraction tooks place
- These has been divided into classification and regression
- Then process of return the predicted coordinates
- Later process will end if there is no return

Statistical Analysis

SPSS(Yockey 2017) software is used for numerical analysis of novel SSD features and the faster R-CNN algorithm. The independent sample t test was executed to find the mean, standard deviation, and the standard error mean numerical importance between the groups, and then the comparison of the two groups with the SPSS software. Dependent variables are accuracy rate and independent variables are image size.

RESULTS

Table 1 displays the Evaluation Metrics of Comparison of Fast R-CNN and novel Single Shot MultiBox Detector (SSD) Classifier. The accuracy rate of the Fast R-CNN model is 94.44% and the novel Single Shot MultiBox Detector (SSD) model has 96.811%.

Table 2 depicts the statistical calculation such as Median, standard deviation, and standard error Median for Fast R-CNN and novel Single Shot MultiBox Detector (SSD). The accuracy rate parameter was utilized in the t-test. The mean accuracy rate of Fast R-CNN is 94.44% and novel Single Shot MultiBox Detector (SSD) is 96.81%.

Table 3 displays the statistical calculations for independent samples tested between Fast R-CNN and novel Single Shot MultiBox Detector (SSD) algorithms. The sig. for accuracy rate is 0.0256. Independent samples T-test is useful for comparison of Fast R-CNN and novel Single Shot MultiBox Detector (SSD) algorithms with the confidence interval as 95% and significance level as 0.12321.

Figure 3 shows the simple bar graph for Fast R-CNN method accuracy rate is compared with the novel Single Shot MultiBox Detector (SSD) Classifier. The proposed novel Single Shot MultiBox Detector (SSD) method is higher in terms of accuracy rate of 96.81% when compared with Fast R-CNN method 94.44%.

DISCUSSION

This study proposes object recognition procedures to identify objects continuously on any gadget running the model and in any location (Arora et al. 2019). The work is intended for identifying the targets continuously from pictures by utilizing deep learning techniques. We have utilized the Matlab programming language to execute the proposed framework. Matlab libraries are the open source system for the development, preparing and recognizable proof of target location.This paper presents the novel Single Shot MultiBox Detector (SSD) method with skip pooling and combination of relevant data. The calculation depends on the novel Single Shot Detector system and adds a component extraction model and skip pooling strategy that coordinates context oriented data and utilizations directed secures with superior execution rather than Fast R-CNN. To demonstrate that it has high identification execution, we directed removal and correlation tests between the proposed novel Single Shot MultiBox Detector (SSD) calculation and Faster R-CNN. Preparing and testing on PASCAL VOC 2008 datasets delivered best in class results. Through trial results, it is observed that the calculation proposed in this work is especially for troublesome issues in the location of moderately blocked and little items

A critical element of our model is the utilization of multi-scale convolutional bouncing box yields connected to various component maps at the highest point of the organization. This portrayal permits us to productively display the space of conceivable box shapes (Zheng, Fu, and Zhao 2018). The SSD model gives a helpful structure square to frameworks that utilize an item distinguishing part. The assessments were completed to exhibit that low-end devices have adequate processing ability to run specific target discovery calculations with an ongoing video feed. It tends to be utilized as a piece of a framework utilizing intermittent brain organizations to recognize and follow objects in recordings at the same time by considering a video as a bunch of casings or pictures taken each in turn at an exceptionally high speed. The assessment metric utilized is mean average accuracy. For a given class, the accuracy review bend is registered (Kanimozhi, Gayathri, and Mala 2019). Recall is characterized as the extent of all sure models positioned over a given position. Accuracy is the extent of all models over that rank which is from the positive class. Subsequently to get a high score, high accuracy is wanted at all degrees of review (Liu et al. 2016). This action is superior to the region under the bend since it gives significance to the awareness. The locations were allotted to ground truth targets and decided to be valid/invalid up-sides by estimating bounding box cross-over (Womg et al. 2018).To be viewed as a right location, the area of cross-over between the anticipated jumping box and ground truth bouncing box should surpass an edge. The result of the identifications doled out to ground truth objects fulfilling the cross-over model were positioned arranged by (diminishing) certainty yield (Kumar, Zhang, and Lyu 2020). Different locations of a similar item in a picture was viewed as misleading discoveries. On the off chance that no expectation is made for a picture, it is viewed as a false negative.

The proposed technique has some drawbacks in the recognition of warped, turning, and secret objects. To additionally further develop the recognition accuracy, and will focus harder on the exploration of troublesome identification. To meet the constant execution of the framework, further review the handling velocity of the method and different problems. Additionally, investigating an object location calculation with solid speculation capacity however impressive computational proficiency will be a significant future examination path.

CONCLUSION

The proposed model exhibits the Fast R-CNN and novel Single Shot MultiBox Detector (SSD) algorithms, in which the proposed SSD has the highest values. The accuracy Rate of the novel Single Shot MultiBox Detector (SSD) method is 96.81% is higher compared with Fast R-CNN that has an accuracy rate of 94.44% in the analysis of the classification of object detection with improved accuracy rate.

DECLARATIONS

Conflicts of Interest

No conflict of interest in this manuscript

Authors Contributions

Author SS was involved in data collection, data analysis & manuscript writing. Author KM was involved in conceptualization, data validation, and critical review of manuscripts.

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REFERENCES

1. Alamsyah, Derry, and Muhammad Fachrurrozi. 2019. “Faster R-CNN with Inception V2 for Fingertip Detection in Homogenous Background Image.” *Journal of Physics. Conference Series* 1196 (1): 012017.
2. Arora, Adwitiya, Atul Grover, Raksha Chugh, and S. Sofana Reka. 2019. “Real Time Multi Object Detection for Blind Using Single Shot Multibox Detector.” *Wireless Personal Communications* 107 (1): 651–61.
3. Baskar, M., R. Renuka Devi, J. Ramkumar, P. Kalyanasundaram, M. Suchithra, and B. Amutha. 2021. “Region Centric Minutiae Propagation Measure Orient Forgery Detection with Finger Print Analysis in Health Care Systems.” *Neural Processing Letters*, January. https://doi.org/10.1007/s11063-020-10407-4.
4. Bhanu Teja, N., Yuvarajan Devarajan, Ruby Mishra, S. Sivasaravanan, and D. Thanikaivel Murugan. 2021. “Detailed Analysis on Sterculia Foetida Kernel Oil as Renewable Fuel in Compression Ignition Engine.” *Biomass Conversion and Biorefinery*, February. https://doi.org/10.1007/s13399-021-

01328-w.

5. Bhavikatti, Shaeesta Khaleelahmed, Mohmed Isaqali Karobari, Siti Lailatul Akmar Zainuddin, Anand Marya, Sameer J. Nadaf, Vijay J. Sawant, Sandeep B. Patil, Adith Venugopal, Pietro Messina, and Giuseppe Alessandro Scardina. 2021. "Investigating the Antioxidant and Cytocompatibility of Mimusops Elengi Linn Extract over Human Gingival Fibroblast Cells." *International Journal of Environmental Research and Public Health* 18 (13). https://doi.org/10.3390/ijerph18137162.
6. Galvez, Reagan L., Argel A. Bandala, Elmer P. Dadios, Ryan Rhay P. Vicerra, and Jose Martin Z. Maningo. 2018. "Object Detection Using Convolutional Neural Networks." In *TENCON 2018 - 2018 IEEE Region 10 Conference*, 2023–27.
7. Girshick, Ross. 2015. "Fast R-Cnn." In *Proceedings of the IEEE International Conference on Computer Vision*, 1440–48.
8. He, Kaiming, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. 2015. "Spatial Pyramid Pooling in Deep Convolutional Networks for Visual Recognition." *IEEE Transactions on Pattern Analysis and Machine Intelligence* 37 (9): 1904–16.
9. Kanimozhi, S., G. Gayathri, and T. Mala. 2019. "Multiple Real-Time Object Identification Using Single Shot Multi-Box Detection." In *2019 International Conference on Computational Intelligence in Data Science (ICCIDS)*, 1–5. ieeexplore.ieee.org.
10. Karobari, Mohmed Isaqali, Syed Nahid Basheer, Fazlur Rahman Sayed, Sufiyan Shaikh, Muhammad Atif Saleem Agwan, Anand Marya, Pietro Messina, and Giuseppe Alessandro Scardina. 2021. "An In Vitro Stereomicroscopic Evaluation of Bioactivity between Neo MTA Plus, Pro Root MTA, BIODENTINE & Glass Ionomer Cement Using Dye Penetration Method." *Materials* 14 (12). https://doi.org/10.3390/ma14123159.
11. Karthigadevi, Guruviah, Sivasubramanian Manikandan, Natchimuthu Karmegam, Ramasamy Subbaiya, Sivasankaran Chozhavendhan, Balasubramani Ravindran, Soon Woong Chang, and Mukesh Kumar Awasthi. 2021. "Chemico-Nanotreatment Methods for the Removal of Persistent Organic Pollutants and Xenobiotics in Water - A Review." *Bioresource Technology* 324 (March): 124678.
12. Kumar, Ashwani, Satya Prakash Ghrera, and Vipin Tyagi. 2017. "An ID-Based Secure and Flexible Buyer-Seller Watermarking Protocol for Copyright Protection." https://scholar.archive.org/work/um7ru77wnrechiddzyteu42ujy/access/wayback/http://www.myjurnal.my/filebank/published_article/57261/5.pdf.
13. Kumar, Ashwani, Zuopeng Justin Zhang, and Hongbo Lyu. 2020. "Object Detection in Real Time Based on Improved Single Shot Multi-Box Detector Algorithm." *EURASIP Journal on Wireless Communications and Networking* 2020 (1): 1–18.
14. Liu, Wei, Dragomir Anguelov, Dumitru Erhan, Christian Szegedy, Scott Reed, Cheng-Yang Fu, and Alexander C. Berg. 2016. "SSD: Single Shot MultiBox Detector." In

Computer Vision – ECCV 2016, 21–37. Lecture Notes in Computer Science. Springer, Cham.

15. Muthukrishnan, Lakshmipathy. 2021. "Nanotechnology for Cleaner Leather Production: A Review." *Environmental Chemistry Letters* 19 (3): 2527–49.
16. Othman, Nashwan Adnan, and Ilhan Aydin. 2018. "A New Deep Learning Application Based on Movidius NCS for Embedded Object Detection and Recognition." In *2018 2nd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)*, 1–5.
17. Preethi, K. Auxzilia, K. Auxzilia Preethi, Ganesh Lakshmanan, and Durairaj Sekar. 2021. "Antagomir Technology in the Treatment of Different Types of Cancer." *Epigenomics*. https://doi.org/10.2217/epi-2020-0439.
18. Ren, Shaoqing, Kaiming He, Ross Girshick, and Jian Sun. 2017. "Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks." *IEEE Transactions on Pattern Analysis and Machine Intelligence* 39 (6): 1137–49.
19. Sawant, Kashmira, Ajinkya M. Pawar, Kulvinder Singh Banga, Ricardo Machado, Mohmed Isaqali Karobari, Anand Marya, Pietro Messina, and Giuseppe Alessandro Scardina. 2021. "Dentinal Microcracks after Root Canal Instrumentation Using Instruments Manufactured with Different NiTi Alloys and the SAF System: A Systematic Review." *NATO Advanced Science Institutes Series E: Applied Sciences* 11 (11): 4984.
20. Shanmugam, Vigneshwaran, Rhoda Afriyie Mensah, Michael Försth, Gabriel Sas, Ágoston Restás, Cyrus Addy, Qiang Xu, et al. 2021. "Circular Economy in Biocomposite Development: State-of-the-Art, Challenges and Emerging Trends." *Composites Part C: Open Access* 5 (July): 100138.
21. Tithi, Aditi, Firoj Ali, and Sadman Azrof. 2021. "Speed Bump & Pothole Detection with Single Shot MultiBox Detector Algorithm & Speed Control for Autonomous Vehicle." *2021 International Conference on Automation, Control and Mechatronics for Industry 4.0 (ACMI)*. https://doi.org/10.1109/acmi53878.2021.9528185.
22. Veerasimman, Arumugaprabu, Vigneshwaran Shanmugam, Sundarakannan Rajendran, Deepak Joel Johnson, Ajith Subbiah, John Koilpichai, and Uthayakumar Marimuthu. 2021. "Thermal Properties of Natural Fiber Sisal Based Hybrid Composites – A Brief Review." *Journal of Natural Fibers*, January, 1–11.
23. Viola, P., and M. Jones. 2001. "Rapid Object Detection Using a Boosted Cascade of Simple Features." In *Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition. CVPR 2001*, 1:I – I.
24. Wang, Yuanyuan, Chao Wang, and Hong Zhang. 2018. "Combining a Single Shot Multibox Detector with Transfer Learning for Ship Detection Using Sentinel-1 SAR Images." *Remote Sensing Letters* 9 (8): 780–88.
25. Womg, Alexander, Mohammad Javad Shafiee, Francis Li, and Brendan Chwyl. 2018. "Tiny SSD: A Tiny

Single-Shot Detection Deep Convolutional Neural Network for Real-Time Embedded Object Detection." In *2018 15th Conference on Computer and Robot Vision (CRV)*, 95–101. ieeexplore.ieee.org.

26. Xiang, Wei, Dong-Qing Zhang, Heather Yu, and Vassilis Athitsos. 2018. "Context-Aware Single-Shot Detector." In *2018 IEEE Winter Conference on Applications of Computer Vision (WACV)*, 1784–93.
27. Yockey, Ronald D. 2017. *SPSS® Demystified: A Simple Guide and Reference*. Routledge.
28. Zheng, Liwen, Canmiao Fu, and Yong Zhao. 2018. "Extend the Shallow Part of Single Shot Multibox Detector via Convolutional Neural Network." In *Tenth International Conference on Digital Image Processing (ICDIP 2018)*, 10806:287–93. SPIE.

TABLES AND FIGURES

Table 1. Comparison of Fast R-CNN and Single Shot Multibox Detector (SSD) algorithm for predicting the classification results of object detection with improved accuracy rate. The accuracy rate of Fast R-CNN is 94.444171 and the Single Shot Multibox Detector (SSD) has 96.811584.

Test Size	Accuracy Rate	
	Fast R-CNN Classifier	**SSD**
Test1	90.222	93.344
Test2	91.212	92.748
Test3	91.113	94.535
Test4	90.193	95.345
Test5	92.827	95.454
Test6	92.101	94.586
Test7	91.273	95.123
Test8	92.335	95.394
Test9	93.748	95.234
Test10	93.233	96.111
Average Test Results	94.444171	96.811584

Table 2. The statistical calculation such as Median, standard deviation, and standard error Median for Fast R-CNN and Single Shot Multibox Detector has been evaluated. The accuracy rate parameter used in the t-test. The mean accuracy rate of Fast R-CNN is 94.44%1 and SSD is 96.81%. The Standard Deviation of Fast R-CNN is 1.93847 and SSD detector is

0.23942. The Standard Error Median of Fast R-CNN is 0.985442 and SSD detector is 0.19901.

Group		**N**	**Median**	**Standard Deviation**	**Standard Error Median**
Accuracy	Single-Shot Multibox Detector	10	96.811584	0.12291	0.12283
	Fast R-CNN	10	94.444171	1.72684	0.88738

Table 3. Statistical experimental designs for independent samples between Fast R-CNN and the Single Shot Multibox Detector are included. Independent T test samples are used to compare Fast R-CNN with Single Shot Multibox Detector with confidence interval as 95% and value level as 0.2323. This independent sample test contains values such as 0.001, significance (2 tails), Median difference, standard error difference, and low and upper interval variance.

Group		**Levene's Test for Equality of Variances**		**T-Test for Equality of Medians**						
		F	**Sig.**	**t**	**df**	**Sig(2-tailed)**	**Median Difference**	**Std.Error Difference**	**95% Confidence Interval(Lower)**	**95% Confidence Interval (Upper)**
Accuracy	Equal variances assumed	9.344	0.0256	18.345	18	.001	12.72683	0.92838	12.34849	15.43893
	Equal variances not assumed			12.182	14.873	.001	11.01839	0.10124	10.03832	13.11939

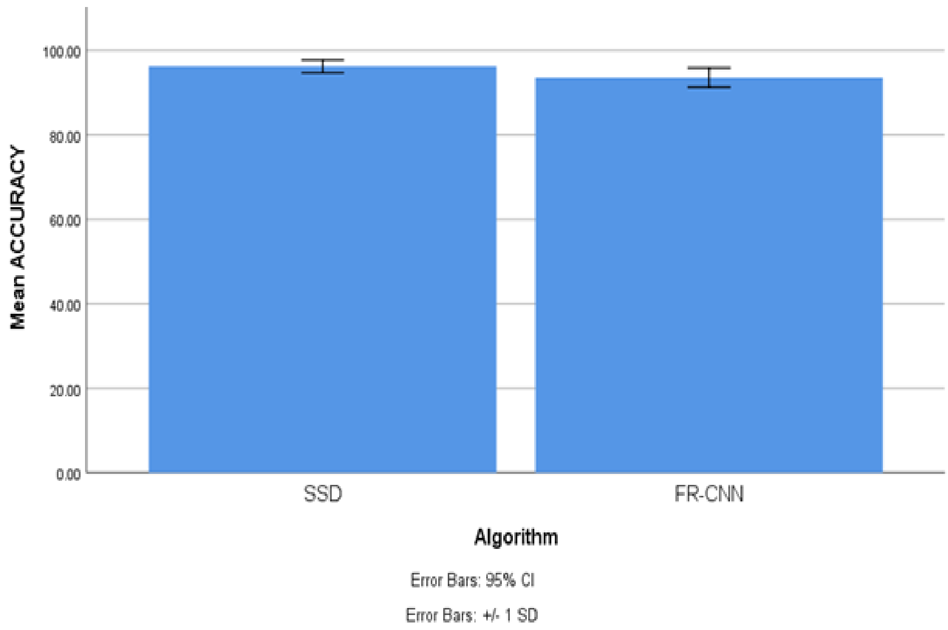

Fig. 1. Simple Bar graph for Fast R-CNN Classifier accuracy rate is compared with Single Shot Multibox Detector Classifier. The Fast R-CNN Classifier is higher in terms of accuracy rate 94.44% when compared with Single Shot Multibox Detector 96.81%. There is a significant difference between Fast R-CNN Classifier and SSD Classifier ($p<0.05$ Independent sample test). X-axis: Single Shot Multibox Detector Classifier accuracy rate vs Fast R-CNN Classifier Y-axis: Median of accuracy rate, for detection of keywords ± 1 SD with 95 % CI.