International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 06 | June - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Clothing Classification using Deep Learning

Prof.Dr. Gifta Jerith
Asst Professor, Malla Reddy University Hyderabad
ggiftajerith@gmail.com

Ch. Hemasree
Student, Malla Reddy University Hyderabad
2011cs020075@mallareddyuniversity.ac.in

Ch. Jayashree
Student, Malla Reddy University Hyderabad
2011cs020076@mallareddyuniversity.ac.in

Ch. Jeevan Santosh
Student, Malla Reddy University Hyderabad
2011cs020077@mallareddyuniversity.ac.in

Ch. Nihanth
Student, Malla Reddy University Hyderabad
2011cs020078@mallareddyuniversity.ac.in

ABSTRACT- Clothing Classification is the way we present ourselves which mainly focuses on vision, has attracted great interest from computer vision researchers. It is generally used to classify clothes as per the formal attire of a particular professional worker. Clothing classification has a huge application when it comes to be used with dress code surveillance. In this project we make use of deep learning (DL) and machine learning (ML) methods to correctly identify and categorize clothing images. Deep learning gives more insights than machine learning models. For better training, we make use of Convolutional neural networks. Clothing Classification uses dataset from keras i.e., a Deep learning library. The dataset is then trained and evaluated as per the parameters of CNN. A CNN model is then evaluated on a test set, achieving decent accuracy, and classifying clothes as per the requirement. Cloth Classification can be used as meta information in many applications. Dress code Surveillance makes use of Clothing Classification as meta information for its working. Classification of images has further augmented in the field of computer vision with the dawn of transfer learning. To train a model on huge dataset demands huge computational resources and add a lot of cost to learning. There are several pretrained models like VGG16, VGG19, Deep learning, CNN, etc. which are widely use.

INTRODUCTION-

Clothing classification using deep learning is a computer vision task that aims to automatically categorize or classify different types of clothing items based on their visual features. Deep learning particularly Convolutional Neural Networks (CNN) has revolutionized the field of image recognition and classification making it an ideal approach for solving complex visual recognition problems like clothing classification.

Clothing Classification using deep learning has numerous applications, including e-commerce platforms, fashion

Recommendation systems inventory management and visual search engines. By automating the classification process, it saves time and effort compared to manual categorization and enables faster and more accurate analysis of large collections of clothing items

Index Terms – Clothing, classification, Deep learning, CNN, Tensor Flow, Keras.

AIM:

Clothing classification plays a significant role in dress code surveillance and allows for the visual categorization of clothing images. Clothing classification using deep learning is about accurately identifying and categorizing clothing items in images.

OBJECTIVE:

The objective of clothing classification using deep learning is to develop a model that can accurately classify different types of clothing items based on their visual characteristics. The model is trained on a large dataset of labelled images, where each image is associated with a specific category or type of clothing (e.g., t-shirt, dress, pants, etc.). The deep learning model learns to extract relevant features and patterns from the images and then uses those features to make predictions about the category or type of clothing item in new, unseen images.

EXISTING SYSTEM:

The field of clothing classification is constantly evolving, with researchers exploring new architectures, techniques, and datasets to improve accuracy and enable more advanced applications in the fashion industry.

There have been several existing systems for clothing classification using deep learning some of the examples are Deep Fashion, VGGNet and ResNet.

PROBLEM STATEMENT:

Given a large dataset of clothing images, the objective is to develop a deep learning model that accurately classifies each image into its corresponding clothing category or type. The model should be able to handle a wide range of clothing items, including but not limited to t-shirts, dresses, pants, skirts, jackets, and footwear etc.

PROPOSED SYSTEM:

In this proposed model we use FASHION -MNIST

Fashion-MNIST is a popular benchmark dataset for clothing classification. It consists of 60,000 training images and 10,000 test images, covering 10 different clothing categories. Many deep learning models, such as convolutional neural networks (CNNs), have been trained on this dataset to achieve high accuracy in clothing classification.

METHODOLOGY:

CNN (convolutional neural networks):

We have used Convolutional neural networks (CNNs) use self-optimizing artificial neurons that work similarly to convolutional neural networks (ANNs). CNN has three layers: a convolutional layer, a pooling layer, and a fully connected layer. Convolutional layers have as their main purpose the generation of features for an image by sliding a smaller matrix (a filter or kernel) over the entire image and generating feature maps. • Reducing the feature maps kept the most critical features of the data. To continue to the output layer, which will output the prediction, we flatten the previous layer's input matrix by linking the bottom-most neurons in the previous layer to the top-most neurons in the next layer. The model's architecture will allow it to train using fewer datasets, which reduces the amount of parameter learning required. CNN has been very good at machine learning applications, and it improves the accuracy and efficiency of applications. In a classification query, feature extraction is a more critical task for image recognition. The CNN was used to learn picture representation and reuse it on large-scale data sets for classification.

MATHEMATICAL MODEL:

Convolution:
The convolution operation in CNNs is used to extract features from input images. Given an input image and a set of learnable filters (kernels), the convolution operation is defined as follows:

Output feature map (activation map) at position (i, j) = sum of element-wise multiplication between the filter and the input image patch centered at position (i, j).

This can be expressed mathematically as:

$$H(i , j)= \sum m \sum n \; I(i+m , j +n).k(m ,n)$$

where H(i, j) is the value in the output feature map at position (i, j), I(i+m, j+n) represents the pixel value in the input image at position (i+m, j+n), and K(m, n) represents the corresponding filter coefficient at position (m, n).

Pooling:
Pooling operations, such as max pooling or average pooling, are used to down sample the feature maps and reduce the spatial dimensionality. The pooling operation computes a single output value for a region of the input feature map. The mathematical formulas for max pooling and average pooling are as follows:

$$H(i , j)=max\ m\ max\ n\ F(i +m , j +n)$$

Max pooling:
$$H(i , j)=max\ m\ max\ n\ F(i +m , j +n)$$
Average pooling:
$$H(i , j)= 1/m\text{-}n \sum m \sum n \; F(i+m , j +n)$$

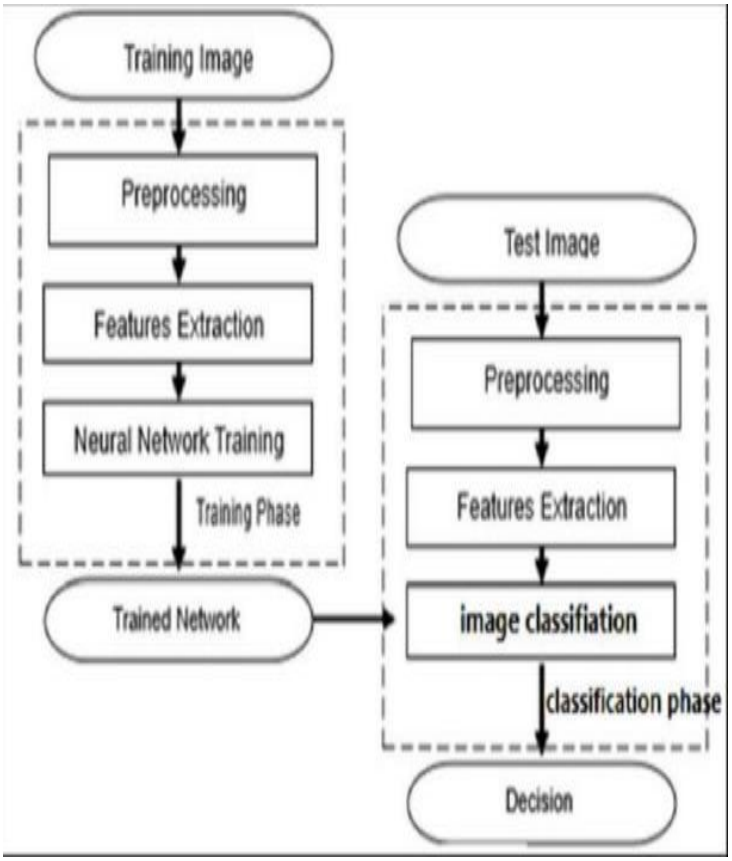
Activation function:
Activation functions introduce non-linearity into the CNN model and help in capturing complex patterns. Some commonly used activation functions in CNNs include ReLU (Rectified Linear Unit), sigmoid, and tanh. The mathematical formulas for these activation functions are:

Relu:
F(x)=max(0,x)

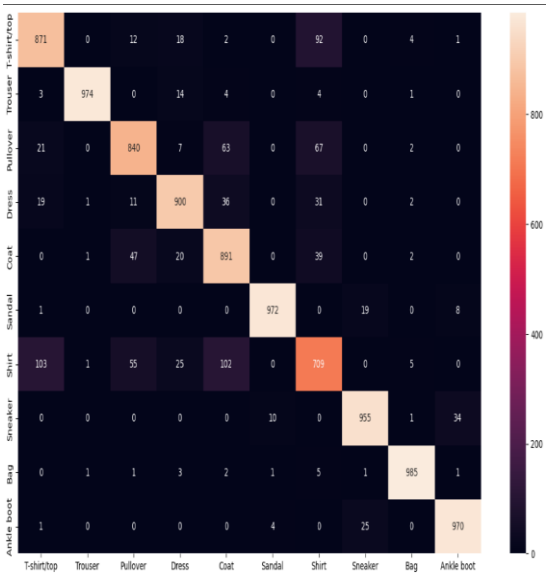
Sigmoid:
F(x)=1/ 1+e^-x

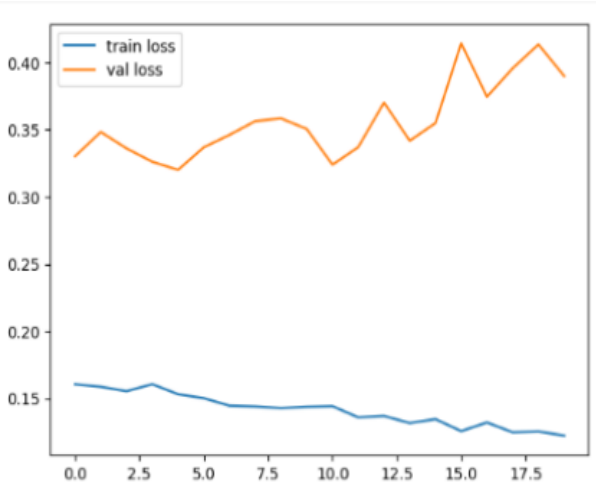
where f(x) represents the output value given the input x.

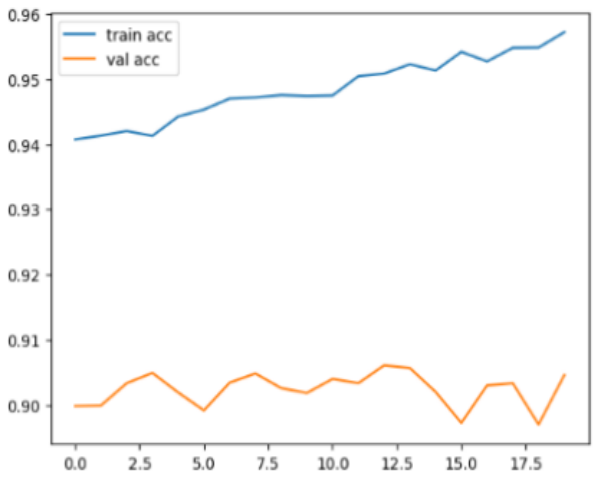
FLOW CHART:



HEAT MAP:







CONCLUSION:

A CNN based model was proposed in this project where clothes classification is done by identifying the images with its Numeric labels. This model can be utilized in Dress Code Detection. We would like to extend this project by using different DL models like RNN-GRU and RNN-LSTM to implement dress code recommendation application

REFERENCES:

1] A. Hodecker, A.M.R. Fernandes, A. Steffens, P. Crocker, V.R.Q. Leithardt, "Clothing Classification Using Convolutional Neural Networks," in Iberian Conference on Information Systems and Technologies, CISTI, IEEE Computer Society, 2020, doi:10.23919/CISTI49556.2020.9141035. [2] R. Boardman, R. Parker-Strak, C.E. Henninger, "Fashion Buying and Merchandising," Fashion Buying and Merchandising, 2020, doi:10.4324/9780429462207.

[3] Y. Zhong, S. Mitra, "The role of fashion retail buyers in China and the buyer decision-making process," Journal of Fashion Marketing and Management, 24(4), 631–649, 2020, doi:10.1108/JFMM-03-2018-0033.

[4] K.V. Madhavi, R. Tamilkodi, K.J. Sudha, "An Innovative Method for Retrieving Relevant Images by Getting the Top-ranked Images First Using Interactive Genetic Algorithm," Procedia Computer Science, 79, 254–261, 2016, doi:10.1016/j.procs.2016.03.033.

[5] L. Bossard, M. Dantone, C. Leistner, C. Wengert, T. Quack, L. Van Gool, "Apparel classification with style," in Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 321–335, 2013, doi:10.1007/978-3-642-37447- 0_25. [6] H. Chen, Z.J. Xu, Z.Q. Liu, S.C. Zhu, "Composite

templates for cloth modeling and sketching," Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 1, 943–950, 2006, doi:10.1109/CVPR.2006.81.

[7] K. He, X. Zhang, S. Ren, J. Sun, Delving deep into rectifiers: Surpassing human-level performance on imagenet classification, 2015, doi:10.1109/ICCV.2015.123.

[8] Z. Song, M. Wang, X.S. Hua, S. Yan, "Predicting occupation via human clothing and contexts," Proceedings of the IEEE International Conference on Computer Vision,1084–1091,2011, doi:10.1109/ICCV.2011.6126355.

[9] K. Yamaguchi, M.H. Kiapour, L.E. Ortiz, T.L. Berg, "Parsing clothing in fashion photographs," Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 3570–3577, 2012, doi:10.1109/CVPR.2012.6248101. [10] K. Meshkini, J. Platos, H. Ghassemain, "An Analysis of Convolutional Neural Network for Fashion Images Classification (Fashion-MNIST)," in Advances in Intelligent Systems and Computing, Springer: 85–95, 2020, doi:10.1007/978-3-030-50097-9_10.

[11] M. Kayed, A. Anter and H. Mohamed, "Classification of Garments from Fashion MNIST Dataset Using CNN LeNet-5 Architecture," in 2020 International Conference on Innovative Trends in Communication and Computer Engineering (ITCE), Aswan, Egypt, 2020, pp. 238-243, doi: 10.1109/ITCE48509.2020.9047776. [12] A. Jain, A. Fandango, A. Kappor, TensorFlow Machine Learning Projects : Build 13 real-world projects with advanced numerical computations using the Python ecosystem, Packt Publishing Limited, Birmingham, United Kingdom, 2018. ISBN13: 9781789132212.

[13] Y. Shin, I. Balasingham, "Comparison of hand-craft feature based SVM and CNN based deep learning framework for automatic polyp classification," Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS, 3277–3280, 2017, doi:10.1109/EMBC.2017.8037556.

[14] S. Vieira, W.H. Lopez Pinaya, A. Mechelli, Introduction to machine learning, 2019, doi:10.1016/B978-0-12-815739-8.00001-8.

[15] O. Theobald, Machine Learning for Absolute Beginners, Scatter Plot Press, 169, 2017. ISBN: 1549617214.

[16] S. Shalev-Shwartz, S. Ben-David, Understanding machine learning: From theory to algorithms, Cambridge university press, 2013, doi:10.1017/CBO9781107298019.

[17] E.L. De Oliveira, "Machine learning techniques applied to predict the performance of contact centers operators," Iberian Conference on Information Systems and Technologies, CISTI, 2019, doi:10.23919/CISTI.2019.8760665.

[18] J. Maindonald, "Pattern Recognition and Machine Learning," Journal of Statistical Software, 17, 2007, doi:10.18637/jss.v017.b05.

[19] I. Goodfellow, Y. Bengio, A. Courville, Deep learning, MIT Press Cambridge, 2016. ISBN: 9780262035613.

[20] A. Peña, I. Bonet, D. Manzur, M. Góngora, F. Caraffini, "Validation of convolutional layers in deep learning models to identify patterns in multispectral images: Identification of palm units," in Iberian Conference on Information Systems and Technologies, CISTI, IEEE Computer Society, 2019, doi:10.23919/CISTI.2019.8760741.

[21] N. Buduma, N. Locascio, Fundamentals of deep learning : Designing NextGeneration Machine Intelligence Algorithms, O'Reilly Media, Inc., 2017. ASIN: B0728KKXWB. [22] Y. Lecun, Y. Bengio, G. Hinton, Deep learning, Nature, 521(7553), 436– 444, 2015, doi:10.1038/nature14539.

[23] K. Fu, D. Cheng, Y. Tu, L. Zhang, Credit card fraud detection using convolutional neural networks, Lecture Notes in Computer Science, 9949, 483–490, 2016, doi:10.1007/978-3-319-46675-0_53.

[24] C. Szegedy, W. Liu, Y. Jia, P. Sermanet, S. Reed, D. Anguelov, D. Erhan, V. Vanhoucke, A. Rabinovich, “Going deeper with convolutions,” in Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 1–9, 2015, doi:10.1109/CVPR.2015.7298594. [25] A. Baldominos, Y. Saez, P. Isasi, "A Survey of Handwritten Character Recognition with MNIST and EMNIST," Applied Sciences, 9 (15), 3169, 2019, doi:10.3390/app9153169.

[26] W. Wang, Y. Xu, J. Shen, S.C. Zhu, “Attentive Fashion Grammar Network for Fashion Landmark Detection and Clothing Category Classification,” in Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 4271–4280,2018, doi:10.1109/CVPR.2018.00449.

[27] L. Deng, “The MNIST database of handwritten digit images for machine learning research,” IEEE Signal Processing Magazine, 29(6), 141–142, 2012, doi:10.1109/MSP.2012.2211477.

[28] E. M. Dogo, O. J. Afolabi, N. I. Nwulu, B. Twala and C. O. Aigbavboa, "A Comparative Analysis of Gradient Descent-Based Optimization Algorithms on Convolutional Neural Networks," in Proceedings of 2018 International Conference on Computational Techniques, Electronics and Mechanical Systems (CTEMS), Belgaum, India, 2018, 92-99, doi: 10.1109/CTEMS.2018.8769211.