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A Hybrid Sampling Approach for Improving the Classification of Imbalanced Data Using ROS and NCL Methods

Ependi, Usman[a, b] ; Rochim, Adian Fatchur[c]; Wibowo, Adi[d]

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[a] Doctoral Program of Information Systems, Universitas Diponegoro, Semarang, Indonesia
[b] Faculty of Science and Technology, Universitas Bina Darma, Palembang, Indonesia
[c] Faculty of Engineering, Universitas Diponegoro, Semarang, Indonesia
[d] Faculty of Science and Mathematics, Universitas Diponegoro, Semarang, Indonesia

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Abstract

This research presents a novel hybrid sampling technique, implemented at the data level, to effectively address imbalanced and noisy data in classification processes. The proposed technique expertly combines two established methods, namely, the random over sampling (ROS) and neighbourhood cleaning rule (NCL) approaches, to tackle imbalance and noise issues, respectively. The study carried out an empirical evaluation of the proposed approach using crowdsourced text data that primarily emphasized the triple bottom line (TBL) dimension of a smart social, economic, and environmental city. The study used the long short-term memory (LSTM), convolutional neural networks (CNN), and CNN-LSTM classification models to validate the efficacy of the proposed hybrid sampling technique and compare its performance with other existing approaches, including ROS oversampling, NCL undersampling, synthetic minority over sampling & tomek links (SMOTE-Tomek), and synthetic minority oversampling and edited nearest neighbours (SMOTE-ENN) hybrid sampling. The results are impressive, with the ROSNCL hybrid sampling technique achieving high accuracy

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A Hybrid Sampling Approach for Improving the Classification of Imbalanced Data Using ROS and NCL Methods

Usman Ependi[1,2]* Adian Fatchur Rochim[3] Adi Wibowo[4]

[1] *Doctoral Program of Information Systems, Universitas Diponegoro, Semarang, Indonesia*
[2] *Faculty of Science and Technology, Universitas Bina Darma, Palembang, Indonesia*
[3] *Faculty of Engineering, Universitas Diponegoro, Semarang, Indonesia*
[4] *Faculty of Science and Mathematics, Universitas Diponegoro, Semarang, Indonesia*
* Corresponding author's Email: u.ependi@binadarma.ac.id

Abstract: This research presents a novel hybrid sampling technique, implemented at the data level, to effectively address imbalanced and noisy data in classification processes. The proposed technique expertly combines two established methods, namely, the random over sampling (ROS) and neighbourhood cleaning rule (NCL) approaches, to tackle imbalance and noise issues, respectively. The study carried out an empirical evaluation of the proposed approach using crowdsourced text data that primarily emphasized the triple bottom line (TBL) dimension of a smart social, economic, and environmental city. The study used the long short-term memory (LSTM), convolutional neural networks (CNN), and CNN-LSTM classification models to validate the efficacy of the proposed hybrid sampling technique and compare its performance with other existing approaches, including ROS oversampling, NCL undersampling, synthetic minority over sampling & tomek links (SMOTE-Tomek), and synthetic minority over-sampling and edited nearest neighbours (SMOTE-ENN) hybrid sampling. The results are impressive, with the ROS-NCL hybrid sampling technique achieving high accuracy rates across all three classification models, at 97.71%, 98.01%, and 98.11%, respectively. This approach provides a robust and effective solution for handling impure data and holds great promise in identifying complex data patterns in real-world classification problems.

Keywords: Citizen opinion, Smart city dimension, Imbalanced data, Hybrid sampling, ROS-NCL.

1. Introduction

The classification process plays a crucial role in identifying various patterns in data. It is frequently utilized to address various challenges, such as identifying fraudulent transactions [1], diagnosing diseases [2], and detecting faults in air handling units [3]. A common issue faced during this process is imbalanced data, where one class has more significant features compared to other groups. This results in the majority-negative and minority-positive classes, where the former has a larger number of data points and the latter has fewer [4]. Given the importance of the minority class in classification, the handling of imbalanced data has become a challenging task in both machine and deep learning, as incorrect predictions may occur. Therefore, addressing imbalanced data becomes a crucial task in the field of classification.

These learning methods are widely employed to identify straightforward and suboptimal classification boundaries when organizing data with imbalanced class problems. The prevalence of this condition demonstrates that minority classes are often misclassified [5]. For instance, the classification of unbalanced data into the dimensions of smart cities aligns with the economical majority and social minority variables, with ratios of 80% and 20% respectively. When minority data is categorized into the negative class, high accuracy is observed, however, this condition becomes unreliable due to the random detection of the small data class [6]. As a result, machine or deep learning classification methods are limited in their ability to handle unbalanced data types.

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Pose Based Multi View Sign Language Recognition through Deep Feature Embedding

Ashraf Ali SK[1] Prasad M.V.D[1] Hima Bindu G[2] P. Praveen Kumar P[3] Anil Kumar D[4]* Kishore P.V.V[1]

[1]*Department of Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, 522302, India*
[2]*Department of Artificial Intelligence and Data Science (AIDS), Vignan's Institute of Information Technology, Duvvada, 530049, Visakhapatnam, India*
[3]*Department of Information Technology, Vignan's Institute of Information Technology, Duvvada, 530049, Visakhapatnam, India*
[4]*Department of Electronics and Communication Engineering, PACE Institute of Technology and Sciences, Ongole, Andhra Pradesh, 523272, India*
* Corresponding author's Email: danilmurali@gmail.com

Abstract: Sign language recognition in real time has been leveraged by the continuously varying hand movements in both shape and orientation across Spatio-Temporal dimensions. This is accomplished by either independent view or shared view feature learning. However, information movement between views is neither total nor restricted to achieve view insensitivity during testing where all views are needed. The objective is to perform pose based multi view sign language recognition by applying triplet loss on a pair of specific and shared view features. Shared view features are obtained using view compatibility matrix which maps within class between view features and between class within view features. This mapping helps in increasing information flow between views from the same class and restricting it between classes thereby making highly discriminative feature representation for all views. Subsequently, metric learning enables to build a view invariant feature embedding by stacking view specific and shared features from different layers for training deep models. In the end, a blended view feature representation is obtained per class. Experiments were designed on our multi view skeletal sign language video dataset and three benchmark action datasets. The results of the experimentation have shown that the performance of the classifier has improved by 8% over the linear view combiners such as Laplacian eigenmaps. Further, the proposed model is useful in constructing a view invariant feature for recognition of multi view sign language.

Keywords: 3D video analysis, Triplet loss, Multi view spatio temporal features, Sign language recognition.

1. Introduction

Sign language recognition (SLR) is an automated machine learning system for the classification of visual information of the human signer into text or voice commands. The visual inputs are in either 2 or 3-dimensional spatiotemporal information [1]. Generally, sign language is a visual form of communication between the hearing impaired or hard hearing people. The language corpus is made from finger and hand movements with respect to the face, head and upper torose of the signer. Particularly, the SLR models used in machine translation used RGB video frames as input. Specifically, some cases considered depth and skeletal sequences for recognition [2]. Appearance features were extracted from RGB and depth sequences whereas pose-based features were operated upon for classification [3]. Unquestionably, the RGB is considered the primary choice as input to the machine interpreters due to availability and cost. However, the results show that the machine learning models find it difficult to extract

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DeepFake Detection Improvement for Images Based on a Proposed Method for Local Binary Pattern of the Multiple-Channel Color Space

Mohammed Thajeel Abdullah[1]* Nada Hussein M. Ali[2]

[1]*Informatics Institute for Postgraduate Studies, Iraqi Commission for Computer and Informatics, Baghdad, Iraq*
[2]*Department of Computer Science, University of Baghdad, Baghdad, Iraq*
* Corresponding author's Email: phd202010564@iips.icci.edu.iq

Abstract: DeepFake is a concern for celebrities and everyone because it is simple to create. DeepFake images, especially high-quality ones, are difficult to detect using people, local descriptors, and current approaches. On the other hand, video manipulation detection is more accessible than an image, which many state-of-the-art systems offer. Moreover, the detection of video manipulation depends entirely on its detection through images. Many worked on DeepFake detection in images, but they had complex mathematical calculations in preprocessing steps, and many limitations, including that the face must be in front, the eyes have to be open, and the mouth should be open with the appearance of teeth, etc. Also, the accuracy of their counterfeit detection in all previous studies was less than what this paper achieved, especially with the benchmark Flickr faces high-quality dataset (FFHQ). This study proposed, a new, simple, but powerful method called image Re-representation by combining the local binary pattern of multiple-channel (IR-CLBP-MC) color space as an image re-representation technique improved DeepFake detection accuracy. The IR-CLBP-MC is produced using the fundamental concept of the multiple-channel of the local binary pattern (MCLBP), an extension of the original LBP. The primary distinction is that in our method, the LBP decimal value is calculated in each local patch channel, merging them to re-represent the image and producing a new image with three color channels. A pretrained convolutional neural network (CNN) was utilized to extract the deep textural features from twelve sets of a dataset of IR-CLBP-MC images made from different color spaces: RGB, XYZ, HLS, HSV, YCbCr, and LAB. Other than that, the experimental results by applying the overlap and non-overlap techniques showed that the first technique was better with the IR-CLBP-MC, and the YCbCr image color space is the most accurate when used with the model and for both datasets. Extensive experimentation is done, and the high accuracy obtained are 99.4% in the FFHQ and 99.8% in the CelebFaces Attributes dataset (Celeb-A).

Keywords: Deep learning, DeepFake detection, Digital image forensics, Image re-representation, Convolutional neural network CNN, DenseNet121.

1. Introduction

DeepFake is a fake face image generated by one of the five facial manipulation techniques entire face synthesis, identity swap, attribute manipulation, expression swap, and miscellaneous [1] These methods concern celebrities and anyone around the globe because the tools and applications to create them are easy to utilize and available. DeepFake uses machine learning (ML) and artificial intelligence (AI) to make deceptive videos and images. Correspondingly, deep learning techniques like autoencoders and generative adversarial networks (GANs) were used to create fake faces that are difficult to expose by humans, even by software [2].

GANs [3] have dramatically improved the realism of high-quality face photos, such as PGGAN [4], StyleGAN [5], etc. Note that this study used a digital manipulation type generated by StyleGAN because it produces impressive results, such as high-resolution facial images with an extremely high level of realism [6]. The StyleGAN unsupervised training procedure produced photos with variations in hair, freckles, and other features. Additionally, it makes the image's artificial controls possible.