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Defending Digital Spaces: Novel Methods for Image and Website Content Control

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ABSTRACT
The internet has become an indispensable tool for communication, information sharing, and entertainment. However, the unrestricted nature of the internet has also brought about a host of challenges, including the dissemination of inappropriate or harmful content. In response to these challenges, various methods of image and website content control have been developed. ImgInspect is software that automatically detects and censors the content of a web page using AI and machine learning. As we all know, there is a great quantity of information and content on the internet, much of which consists of pornographic and violent photos and movies. How to reliably determine the bare picture is a crisis that needs to be answered right now because the distribution of nude photographs on the Internet contributed to a lot of social issues. Furthermore, the current state of affairs makes it simple for even a young child to obtain these contents. The programme that ImgInspect wants to offer can be installed on a computer and will automatically block certain contents and websites, protecting the online safety of young brains. An administrator has control over this function. Due to constraints, this project's scope will solely cover the censorship of violent imagery.

***Keywords* -** Image censing, Nude image detection, Unwanted image

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I. INTRODUCTION

These days, there is a huge volume of nude content on the Internet, which is really bad for teenagers' bodies and minds. Creating a reliable screening and filtering solution to block access to unexpected nude photos by examining image content is a necessary and pressing task. The most recent literature on the subject contains a lot of study attempts. Several filtering programmes work by correlating lists of IP addresses and URLs to prevent access to problematic websites. These solutions can't refresh listings very often because the internet is so dynamic and websites change frequently. Therefore, a method of classifying problematic photos and preventing access to sites that contain disagreeable content is required.

Wang [1] suggested utilizing Daubechies' wavelets, normalized contributory factors, and a color histogram to create a naked picture identification method. Bosson [2] first identified skin lumps before computing their surface, centroid, length of axes, eccentricity, firmness, and extension. Some research on skin detection is focused on additional human features such human [3] facial curves, body shapes [4], and even the ability to appraise suspicious spots [5]. Many nude picture recognition systems rely on low-level visual characteristics. However, these features are often insufficient for distinguishing between nude photographs and photos with big sections of exposed skin that are not explicit. As a result, these systems can struggle to accurately identify nudity. Some Literature has suggested a number of strategies to improve the content-based image classification's accuracy.

Bosson [2] reported the performances of the four distinct classifiers, which were analyzed and discussed. Jeong developed an SVM classifier that used the likelihood of skin for each pixel in an adjusted pictures as its primary feature. Wang [7] employs a neural network to understand these arrangements and can correctly identify the bikini image 80% of the time.

Depending on a training database made up of numerous skin and non-skin pixels, Jones et al. [8] established a model for statistically determining skin tone in the RGB color plot. The likelihood proportion governed by the Bayes theorem can applied to categorize individual pixels as either skin or non-skin. Once a skin-filtered image has been produced, certain features of skin areas, such as their dimensions and the proportion of their width and height to the overall picture size, can be analyzed to identify nude images. This method has achieved an accuracy rate of 85.8%.

For the purpose of detecting nudity, Lopes et al. [9] employed the bag of visual words (BOVW) technique for picture classification.

The process for this method involves using HueSIFT, which is a modified version of the SIFT descriptor [10]. HueSIFT incorporates weighted hue histogram data and extracts feature point descriptors [11] from an image. After that, SVM is used to classify the descriptors using a BOVW dictionaries with a set size. [9] Unlike other methods, this approach does not rely on any skin color models. Through 10 iterations of 5-fold cross-validating, the approach acquired an overall success rate of 84.6%.

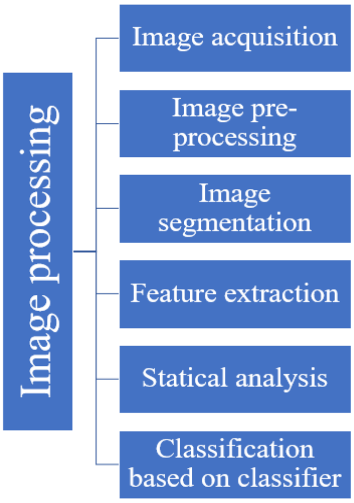

Fig. 1: Image processing

Image processing and image censoring can be related in certain ways, as some image censoring techniques may involve image processing methods. One way these two fields can be related is by using image processing techniques to remove or obscure certain parts of an image for censorship purposes. For example, applying a blur filter to conceal sensitive or inappropriate content in an image is an image processing technique being used to achieve the goal of image censoring.

Another way they can be related is by using image processing to enhance some parts of an image while censoring others. For instance, in a news broadcast, specific parts of an image may be censored for decency or privacy reasons, while the rest of the image can be enhanced to highlight essential details. Here, both image processing and image censoring are utilized to achieve different goals within the same image.

However, it's important to note that despite their potential relationship, image processing and image censoring are distinct concepts with different objectives and methods. Image processing aims to enhance an image's quality and usefulness, while image censoring aims to modify image content to meet certain standards of decency or appropriateness.

There are several other ways in which image processing and image censoring can be related. Firstly, image processing techniques can be utilized to restore or improve censored areas of an image. For instance, in historical documents or artworks where parts of the image have been censored due to censorship laws or damage, restoration algorithms can be utilized to recover and enhance the original content.

Secondly, image processing methods can be used to recognize and censor specific types of content in an image. For example, facial recognition algorithms can be utilized to identify and blur out faces in an image for privacy reasons. Similarly, text recognition algorithms can be used to detect and censor sensitive text in an image.

Lastly, image processing can be employed to simulate censorship in particular contexts. For instance, in scientific or medical research where images may contain confidential or sensitive information, image processing techniques can be used to simulate censorship by blurring out specific parts of the image or masking them with other content.

It's important to remember that while image processing and image censoring can be related, they are two distinct concepts that serve different purposes and require different techniques and tools to accomplish their objectives.

II. LITERATURE SURVEY

Image segmentation technology has been proposed for use in digital image processing and has become increasingly important as China's image processing industry has matured and expanded into various industries [12]. Image segmentation techniques have proven valuable in fields such as remotely sensed engineering, fire detection and prediction, biomedicine, and transportation. However, there are some issues by the use of digital picture segmentation, including sluggish processing rates, low flow, and broad frequency. To address these challenges, it is essential for scientists to identify these problems and take appropriate action to facilitate the implementation of digital image segmentation technology. As a crucial element of China's economic development in certain areas, digital image segmentation technology is increasingly necessary.

We looked for previous review papers in this field before starting our literature review. Two survey articles that categorized various nudity detecting strategies were found. According to Ries et al. [13], visually adult image recognition systems are typically classified into three categories: based on skin tone, shape, and regional characteristics. According to research, methodologies based on color and shape are considered vigorous than methods that rely solely on color-based techniques, as they tend to reduced false positive rates and higher genuine positive rates. [14] Shayan et al. operated a literature review of various methods for detecting pornographic images and filtering adult content. They have divided adult image filtering methods into three categories: blacklists based on keywords, IP addresses, and visual material. For pornographic picture recognition techniques, they employed the same three categories as Ries et al. [13]. They claimed that the absence of a common dataset and terminology for this field prevents a quantifiable comparison of various methods.

These literature reviews organized the various methods for detecting pornographic and adult content, as well as some of the difficulties in putting them into practice, however, their review did not specifically focus on the intersection of machine learning on internet safety for adolescents and nudity or skin detection methods. We contend that in order to use such ideas in actual settings, more human-centered strategies are required. In order to undertake our literature study on teenage internet safety and nudity recognition algorithms, we adopted a more human-centric stance.

Over the past decade, both academic researchers and businesses have been exploring various methods for detecting nudity and skin in images, with the goal of indirectly combating the spread of child pornography. For example, companies such as Facebook, Twitter, and Bing have developed detection and mitigation strategies in partnership with organizations like the National Center for Missing and Exploited Children's Child Victim Identification Program to locate and remove illegal images of minors. The methodologies used in both academic and industrial research, however, have significant limits. The solutions generally concentrate on stopping the spread of child pornographic pictures rather than actively shielding teenagers before the harm has already been done. As a result, there is a requirement for more efficient and teen-focused methods to address the issue at its root and stop the production and spread of such imagery.

In a 1996 study on the detection of human nudes, Forsyth et al. [15] utilized a large dataset of photographs to determine whether or not they contained nude human subjects. Their approach involved analyzing the shape, structure, and color of the images to first identify the presence of humans, and then determine whether or not they were nude. Then, skin areas were identified by combining various RGB color schemes. This was then sent into a customized grouper along with texture information to group human figures based on geometric data and human structure. The use of a comparable strategy was also prevalent [16][17][18].

The method based on the structure of the human body depicts naked or barely clad individuals as groupings of cylindrical objects, with each object representing a piece of the body. This method uses texture and color information to identify skin-colored pixels. When these areas are found, they are given to a specific grouper, which tries to combine them into the shapes of individuals utilizing the human structure's geometric barriers. Following this strategy, [19] suggested a method for employing a projections classifier to prune a brute force search in a large number of candidate pieces. The investigation for limb configurations is effective when done in this manner. [20] suggested a probabilistic architecture that started with segment discovery and used incremental sampling to produce assemblies based on a learnt probabilistic model from the fragments. Finally, the set of the structure is replaced by a tiny number of representations. The strategy permitted both top-down and bottom-up reasoning. This trimming process can prevent being overrun by several segments.

Researchers used a variety of comparable techniques to identify naked images by taking the following stages into account: The skin filter is the initial step. This phase is crucial since nude photographs have a high correlation with images that have extensive skin regions. Skin detection can be accomplished through various methods, such as color space analysis, texture analysis, and statistical modeling, the skin filter is utilized to separate regions that are presumed to be skin from those that are not examined the effectiveness of histogram models and mixture models in skin filters and discovered that histogram models performed the best in terms of accuracy and computational cost. They used aggregate attributes calculated from the data to create an astonishingly excellent nudity detector for people.

The method based on the structure of the human body and depicts barely dressed or naked humans as groups of cylinders, with each cylinder standing for a piece of the body. This method uses texture and color information to identify skin-colored pixels. When these areas are found, they are given to a specific grouper, which tries to combine them into the shapes of individuals utilizing the human structure's geometric barriers. The experimental findings demonstrate that this strategy is inaccurate and ineffective for grouping specialists at a pace of about 10 per hour. A method for employing a projections classifier to prune a brute force search in a large number of candidate pieces. The exploration for limb configurations is effective when done in this manner. a probabilistic approach that started by locating segments and then utilized incremental sampling to create assemblies based on a likelihood model that was learned from the segments. Ultimately, the group of the construction is replaced by a tiny number of representations. The strategy supported both top-down and bottom-up reasoning. This trimming process can prevent being overrun by several segments. A pattern of Daubechies' wavelets, color histograms, and standard central moments can be used to extract semantically- momentous feature vectors from pre-marked training datasets and query images, allowing for fast and effective image comparison. While combining skin color analysis with CBIR to determine whether humans are visible in the image. This strategy was designed utilizing the KNNS method, which accelerates up the entire system throughout the retrieval process. Together, these resulted in fewer false positives while maintaining a high rate of true positives. In the meantime, CBIR algorithms were employed to find videos with naked people. In order to extract the area of interest (ROI), the background region is first removed using skin detection, and the extracted region is then extracted utilizing color, texture, and shape for comparable image retrieval. Last but not least, 100 comparable photographs will be pulled from a collection and compared for resemblance to determine whether or not they are naked.

Researchers used a variety of comparable techniques to identify naked images by taking the following stages into account: The skin filter is the initial step. This phase is crucial since nude photographs have a high correlation with images that have extensive skin regions. By using color plot, textures, or numerical methods for skin modelling, the skin filter is utilized to separate regions that are presumed to be skin from those that are not. Histogram models were discovered to behave better than mixture models in terms of accuracy and computational cost when used in skin filters. Using aggregate features computed, they created a very effective detector for nudity individuals. The skin filter has also been created using this color model. Also, a maximum entropy skin detection model (also known as the first imperative model) was presented. The color gradients of nearby pixels were constrained for this model. The monochromatic skin chart with the potential of skin was the result of the skin detector. Regional Fit Ellipse and Globally Fit Ellipse, two straightforward characteristics, are applied to each skin map. The two-color spaces that are most frequently utilized are HSV and YCbCr. However, some researchers have utilized three color schemes simultaneously (YIQ, YUV, and HSV), whereas others have used a combination of two-color spaces, YUV and YIQ. Comparable skin-colored backdrops, like a yellow couch, sands, woods, or wildlife, have been observed to influence the outcome of detection. To address these issues, the Gray Level Co-Matrix (GLCM) surface ideal was chosen. The Bayesian method using the segment adjacent-nested (SAN) back-propagation neural network on RGB and the clustering histogram on YCbCr are methods used to simultaneously tackle the problem of changing illumination settings and reflections from water and glass. Bayes skin classifier on RGB with Gaussian Mixture Model (GMM) are some of the numerous methods used to handle problems with changing lighting conditions. Numerous strategies, including morphological surgery, edge, and smoothness are utilized to handle additional issues that frequently arise in skin filtering, such as backgrounds or supplementary items that have colors that are related to skin and cause errors in detection.

The subsequent stage is feature extraction, involves finding the crucial properties that can determine whether an image contains bare parts. Features of the skin's surface areas are obtained working on color, texture, geometry, and edges. These features are used among the attributes of the skin's surface and the categorization input with the expectation of producing excellent performance. Utilizing the color histogram and color coherence vector (CCV) as input categorization with distinct features related to skin regions, correlation analysis and self-organizing feature maps (SOFM) have been employed to identify the existence or nonexistence of the navel feature and supplementary key characteristics linked with nudity. The junction of the four rectangles, which are the body's primary rectangles, can be used to locate the navel, which represents the body's center. High-level features with a dataset divided into five categories: nude, benign people (people in various poses), there are only a few persons, random, and graphic images between the shoulders and the head used. Nakedness is defined as images that contain people displaying their sexual organs or engaging in sexual acts.

In the final stage, classification algorithms are utilized to forecast the input images among them are SVM, k-nearest neighbor, Bayes Judgment, Neural Network (NN), Adaboost, MLP, and FP-NN (Forward Propagation Neural Network). The McCulloch-Pitts neural model is represented geometrically in FP-NN, a neural network machine learning technique, and it has been found to be highly effective in experimental studies. To train the MLP and Neuro Fuzzy combination based on a fuzzy integral, it makes use of a vector of chosen features. Another multi-agent learning technique introduced by some researchers is the Bayesian technique with a clustering histogram (GH) on YCbCr and the back-propagation neural network with an adjacent-nested segmentation (SAN) on RGB, which offers higher speed and better performance on images of different sizes. In order to improve a poor classifier's performance, investigators have integrated the AdaBoost algorithm with several classifiers, like the Multi-Layer Perceptron, Decision Stump, C4.5, and SVM.

Other investigators have used the proportion of skin regions as a categorization tool, flagging images as nude if the proportion falls between 20% and 50%. The three largest skin patches of an enclosing polygon are utilized for photo categorization. The RSOR algorithm compares the percentage of skin-color pixels in the original picture and in the image composed of or divided into segments, flagging images as naked if the proportion exceeds 25%, while it is listed as not naked when the fraction of the largest region is less than 35%, as expected.

III. PROPOSED METHODOLOGY

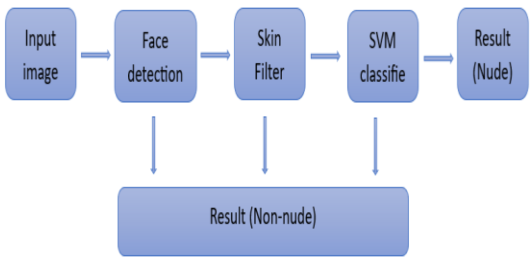

Fig. 2: Proposed model of ImgInspect

According to figure 2, the suggested system has three main modules. The non-nude photographs are categorized using facial detection and the skin filter. The nonlinear-SVM that assesses whether or not images are "nude" generates the image feature vector from the images passing skin filter.

A. Face detection

Nude photos are those that have numerous faces or many close-up faces, as shown in figure 2. The suggested method makes advantage of Viola and Jones's face detection algorithm [21] to address this issue. If the entire face area or the greatest face area after performing face detection exceeds the set limit, the image is categorized as a non-nude picture.

B. Skin filter

Detecting skin pixels is crucial since there is a significant association between the percentage of skin and a pornographic image. The skin pixels are recognized using the RGB color system. Using Gaussian mixture models, skin color and non-skin color are modelled. One of the region-based skin detection systems, flexible skin segmentation method [22], is used to identify skin regions. The homogenous quality of skin areas is the texture unique to human skin. Nonetheless, skin homogeneity is not used in pixel-based techniques. As a result, skin regions may be located more precisely using region-based skin detection methods than they can with pixel-based ones. False skin regions, or nonhomogeneous regions, are seen in pixel-based results. However, the results of adaptive skin segmentation indicate that most fake skin regions are not recognized. The suggested approach is capable of more precise skin region detection via adaptive skin segmentation.

C. SVM classifier

The SVM algorithm utilizes a kernel function to transform the data into a high-dimensional space, where it can distinguish between the two classes through identifying the hyperplane that maximizes the distance across them. Due to its effectiveness and reliability, SVM is frequently used for classification tasks. In this study, SVM [23] is used to differentiate between naked and non-naked images. The SVM algorithm receives as input the top-level features computed from the skin region image.

D. Skin Tone Detection

Skin tone detection involves analyzing the color of the pixels in an image to identify skin tones. This approach can be used to detect images that contain skin tones in a specific range. The algorithm can utilize a model for skin color to differentiate pixels as either skin or non-skin depending on various characteristics like color, texture, and additional features. Skin tone detection can be effective in detecting images where the subject is nude or partially clothed, and where the skin is clearly visible. However, it may not be reliable in images where the subject is not visible or if the skin tone is similar to other colors in the image.

E. Object Detection

Object detection involves using machine learning algorithms to identify specific objects in the image. For example, if a certain object is identified in an image, such as a penis or a breast, the image can be classified as explicit. Object detection can be useful in detecting images with explicit content, but it requires a large dataset of labelled images to train the algorithm. Additionally, it may not be effective in detecting images with ambiguous or hidden content.

F. Image Recognition

Image recognition involves training a machine learning algorithm to recognize explicit content by analyzing patterns and features in the image. This method can be more effective than skin tone detection or object detection, as it can identify explicit content in a wide range of image types and contexts. Image recognition can be trained on large datasets of labelled images, and it can be improved over time with additional training and feedback. However, it can also be prone to false positives and false negatives, depending on the quality and diversity of the training dataset.

G. Metadata Analysis

Metadata analysis involves analyzing the metadata associated with an image, such as the file name, date, and location. Certain metadata patterns can indicate that an image is explicit, such as the use of certain keywords or the presence of adult content warnings. Metadata analysis can be a quick and simple way to flag potentially explicit content, but it is also easy to manipulate or obscure metadata in an image.

H. Hybrid Approaches

Combining multiple methodologies can improve the accuracy of naked image detection. For example, a combination of skin tone detection and image recognition can be more effective than either method used alone. Hybrid approaches can be tailored to specific use cases and can be optimized to balance false positives and false negatives. However, they may require more computational resources and can be more complex to implement and maintain.

IV. PROPOSED ALGORITHM

We presented a novel way to detect nude photographs by evaluating the benefits and limitations of the existing strategies. The method involves utilizing traits that are based on both content and images and consists of the subsequent three steps:

Step 1: Face recognition → filtration of colors → texture evaluation → assessment of skin regions

Step 2: Color histogram vector extraction → Principal Component Analysis (PCA) → SVM sorting

Step 3: Extraction of color coherence vectors → Principal Component Analysis (PCA) → SVM sorting

[24] An approach known as skin region removal is a content-based technique that seeks to identify nude images by analyzing how the skin area has been removed. Because nude images typically contain significant amounts of skin regions, the distribution of skin regions can be a useful indicator for distinguishing between suspicious and benign nude photographs. Two image-based algorithms, namely [25] and [26], by examining the color coherence vector and the color histogram vector (CCV), it is possible to distinguish nude pictures. which are two essential color properties with somewhat different color distributions in innocent and nude photos. All three of these methods' categorization results are examined to make a final decision.

The image's histogram shows how each pixel's color is distributed. The color histogram is represented as a vector H with values h1, h2, …, hn. Each hj indicates the number of color-information-containing pixels in the jth bin. Our approach uses 512 bins in total, with each channel divided into eight uniformly sized segments. Therefore, the color histogram vector has 512 dimensions.

Nevertheless, lack of spatial information in the color histograms, they may be comparable for images that have very distinct looks. We use the color coherence vector, a fundamental image feature, to improve performance. The CCV feature differentiates more clearly than features that just use color information because it considers both the color coherent vector (CCV) measures the spatial coherence of pixels with similar colors and their color information. Similar to the computation of the CHV, 512 bins comprise the RGB color system with 8 segments per color channel. The calculation of the CCV involves examining the coherence and discordance of each color group. Overall, the CCV has 1024 measurements (512 x 2).

As the CHV and CCV feature vectors have a high dimensionality and contain redundant information, they can potentially confuse the classifier. To avoid this, Principal Component Analysis (PCA) is used to lower the dimensionality, before submitting them to the SVM algorithm of the feature vectors. Based on experiments, it has been found that the first 100 components can capture over 97% of the variation in the features.

V. RESEARCH AND DISCUSSION

The outcomes of this research have provided insights to hide sensitive information and content about it as well as to block or unblock certain websites based on user requirement. By all the research and analysis, we proposed this technology. It includes regarding the technology and proposing it in a right way and then implementing it in a proper thoughtful manner which could help the society.

Fig. 3: Home page

The above figure is the welcome page where user will be landed when they visit our website. This website will be generally use to block certain website which are used by people to socialize nudity content or inappropriate image. The website blocker serves as an education tool for users who attempt to access blocked websites. It can help promote responsible and safe internet use and prevent users from accessing harmful or inappropriate content.

Fig. 4: Block and unblock page

The figure 4. shows that it can block and unblock particular websites which will allows users to control access to specific websites. This tool can be used in organizations or individuals who want to restrict access to certain websites, such as parents who want to block their children from accessing adult content or employers who want to prevent employees from accessing distracting or non-work-related websites. Also, user can perform block and unblock action on a particular website by using this web application.

To block a website, the user would typically enter the website's URL or domain name and just click on block button. Once the website is added to the blocked list, anyone who attempts to access the website from a device connected to the network will be redirected to a blocking page that informs them that the website is blocked.
To unblock a website, the user needs to just enter the website's URL or domain name and just click on unblock button. Once the website is removed from the blocked list, users will be able to access it again.

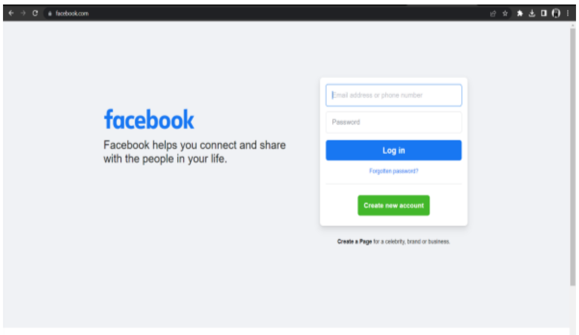

Fig. 5: Facebook website log-in page

The above picture depicts that a user has tried to access a social media where some people use these social media platforms to broadcast the nude images or videos either intentionally or for fun purpose. Now days teenagers are using these social media platforms actively which results that they become so addicted to these things and later on it affects very harshly to their mental state and slowly they became addicted to these pornographic contents.

Fig. 6: Website blocking page

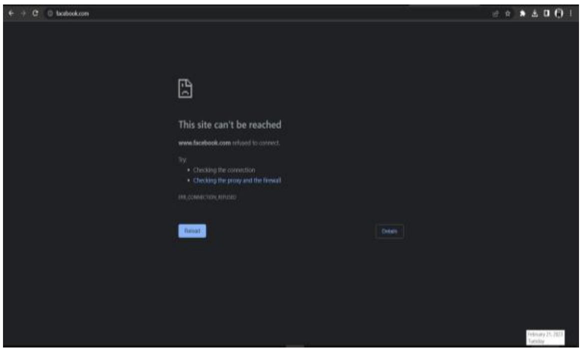

Fig. 7: Facebook website blocked

The above two images fig. 6 & 7 depicts that one of the social media sites has been blocked on your system so that teen age peoples will not able to access those sites while using the systems, and they can surf on the internet safely and will not able to access inappropriate content.

Fig. 8: Website unblocking page

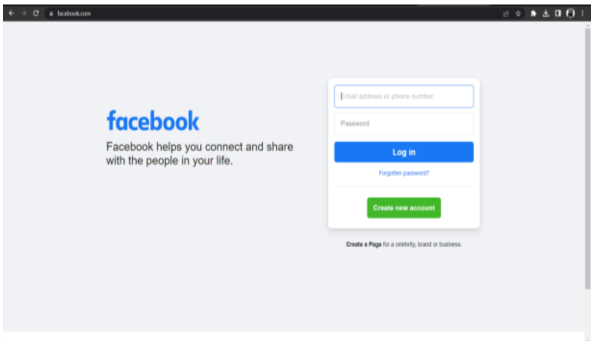

Fig. 9: Facebook website is unblocked

Consider a situation where you want to access these social media sites for some valuable reason at that time you just need to unblock those sites that are have been blocked on your system using this web application, so the fig 8 & 9 presents that now you can able to access the site that have been blocked on your system previously.

VI. CONCLUSION

In summary, this research paper proposes innovative methods for protecting digital spaces by effectively controlling image and website content. Previous research has shown that conventional content filtering techniques, such as keyword-based filtering and blacklisting, have limitations regarding accuracy, scalability, and adaptability. To address these challenges, new approaches such as machine learning-based filtering, image recognition, and context-based analysis have been introduced.

Additionally, ethical concerns related to image and website content control are discussed, including the potential trade-off between free expression and censorship. The study contends that transparent and accountable decision-making processes can facilitate effective content control while avoiding such issues.

The case studies included in this paper demonstrate how these novel methods are effective in managing inappropriate content without infringing on user privacy and autonomy. Overall, these new techniques offer promising solutions for safeguarding digital spaces and preventing exposure to harmful online content.

In conclusion, this study contributes significantly to the field of image and website content control, providing insights into the limitations of traditional approaches and proposing new solutions to enhance the effectiveness, scalability, and adaptability of content filtering. This research can stimulate further discussion and investigation in this constantly evolving area.

The development of sensors may be driven by technologies other than materials technology. For instance, the ImgInspect system was proposed to help hide sensitive content and detect unwanted images. As opposed to the sensor transducer, some cutting-edge sensor technologies, like photon-scattering and laser acoustics, may need materials advancements to support particular applications.

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