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# Brain Tumor Detector

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***Abstract: The Brain Tumor Detection App is a mobile application that uses advanced algorithms to detect brain tumors from medical images. The app allows healthcare professionals to quickly and accurately diagnose brain tumors, which is critical for early treatment and improved patient outcomes. The app is designed to be user-friendly and efficient, with a simple interface that allows for easy image upload and analysis. The application is capable of providing accurate results within a short amount of time. It uses a combination of radionics and morphometric features to evaluate medical images. With the increasing prevalence of brain tumors, the Brain Tumor Detection App has the potential to revolutionize the way we diagnose and treat these complex conditions, improving the quality of care for patients worldwide. The application is designed to be easy to use and highly efficient. The application is designed to be used directly by physicians, enabling them to quickly and accurately detect the presence of a brain tumor in a medical image.***
***Keywords: Brain Tumor Detection, Convolutional Neural Network, computer-aided technology, image processing Python, Java, Magnetic resonance imaging (MRI), Mobile application development, User interface design, radionics, neural network, medical images, deep learning, app development, Machine learning algorithms.***

## I. INTRODUCTION

Brain tumors are a critical health problem that can lead to serious complications, including neurological deficits and even death. They can occur at any age and can lead to various complications, including seizures, and cognitive dysfunction. The timely diagnosis of brain tumors is crucial for effective treatment and improved patient outcomes. However, the accurate detection of brain tumors from medical images is a challenging task that requires expertise and experience. Recently, deep learning techniques have shown remarkable success in medical image analysis, particularly in the area of computer-aided diagnosis. Convolutional neural networks (CNNs), a type of deep learning model, have shown promising results in various medical image analysis tasks, including the detection of brain tumors.

The Brain Tumor Detection app uses a CNN model to analyze MRI images and detect the presence of tumors. The proposed app provides a user-friendly interface that allows users to upload an MRI image and obtain a prediction of whether the image contains a brain tumor. The application has been developed using python in the backend and java in the front end. The user interface is designed to be user-friendly and intuitive. The user interface includes a predict button, which initiates the CNN model's prediction process. We developed the proposed brain tumor detection app using a CNN model trained on a dataset of MRI images from the Brain Tumor Segmentation Challenge. The CNN model was trained using a transfer learning approach, where a pre-trained model was fine-tuned on our dataset. The app's performance was evaluated on a separate test set of MRI images, and we report the accuracy, sensitivity, and specificity of our model. Our brain tumor detection app is designed to assist healthcare professionals in detecting brain tumors from MRI images. The app is user-friendly and easy to use, making it accessible to healthcare professionals with varying levels of experience in radiology and imaging analysis. The app's user interface is simple and intuitive, with a single page that includes an image upload button, a ‘Predict’ button, and an area for displaying the prediction results. To detect a brain tumor from an MRI image, the user uploads the image by clicking on the image upload button. The app only accepts MRI images in standard DICOM format, which is the standard format used in medical imaging. Once the image is uploaded, the user clicks on the predict button, and the app uses a pre-trained CNN model to analyze the image and determine whether it contains a brain tumor.

The CNN model used in the app was trained on a dataset of MRI images from the Brain Tumor Segmentation Challenge. The model was fine-tuned using transfer learning on our dataset, which consists of 1500 MRI images of patients with brain tumors. The CNN model is a deep learning model that uses multiple layers of convolutional and pooling layers to extract relevant features from the input image. The output layer of the model is a SoftMax layer that provides the probability of the input image containing a brain tumor.

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In summary, our brain tumor detection app is a valuable tool for healthcare professionals in diagnosing brain tumors. Its user-friendly interface and accurate predictions make it accessible to healthcare professionals with varying levels of experience in radiology and imaging analysis.

## II. LITERATURE REVIEW

CNNs have been widely used in plant disease image analysis, image recognition, and other fields. In the area of disease detection, CNNs have already shown impressive results.

This research article [1] presents a smartphone-based system for brain tumor detection using a deep learning model. The authors developed an app that can analyze MRI images and detect brain tumors with an accuracy of 93.3%.

This article [2] proposes a mobile app for brain tumor detection using the MobileNetV2 architecture. The app was tested on a dataset of 3,135.MRI images and achieved an accuracy of 98.92%.

This article [3] presents a smartphone-based deep learning platform for brain tumor detection using an ensemble of 3D convolutional neural networks. The authors achieved an accuracy of 95.56% on a dataset of 220 MRI images.

This article [4] proposes a mobile-based deep-learning framework for brain tumor classification and segmentation. The authors used the Inception-V3 architecture and achieved an accuracy of 97.2% on a dataset of 180 MRI images.

This article [5] presents a mobile app for brain tumor detection using a deep learning model. The authors achieved an accuracy of 94.4% on a dataset of 150 MRI images.

In this research article [6] the authors propose a smartphone-based system for brain tumor detection using deep learning algorithms. The app was tested on a dataset of 50 MRI images and achieved an accuracy of 94%.

This article [7] presents a mobile app for brain tumor detection and classification using the MobileNetV2 architecture. The app was tested on a dataset of 210 MRI images and achieved an accuracy of 95.23%.

In this article [8] the authors propose a mobile-based system for brain tumor detection and classification using deep learning. The app was tested on a dataset of 180 MRI images and achieved an accuracy of 97.22%.

This research paper [9] presents a mobile app for brain tumor classification using a deep learning model. The authors achieved an accuracy of 97.5% on a dataset of 190 MRI images.

In this study [10] the authors propose a mobile app for brain tumor classification using the MobileNetV2 architecture. The app was tested on a dataset of 300 MRI images and achieved an accuracy of 96.7%.

## III. METHODOLOGY

The creation of the app and making it unique among others is indeed not an easy task. It's not only about selecting the perfect approach or model, rather it's about making the approach or model work for you in the best way possible. Also, there are a few steps followed so that the application turns out to be error-free and unique among the others. The steps involved in the detection of brain tumor include building and training the model, testing the model, etc. Below is the Software Development Life Cycle (SDLC) of the application designed:

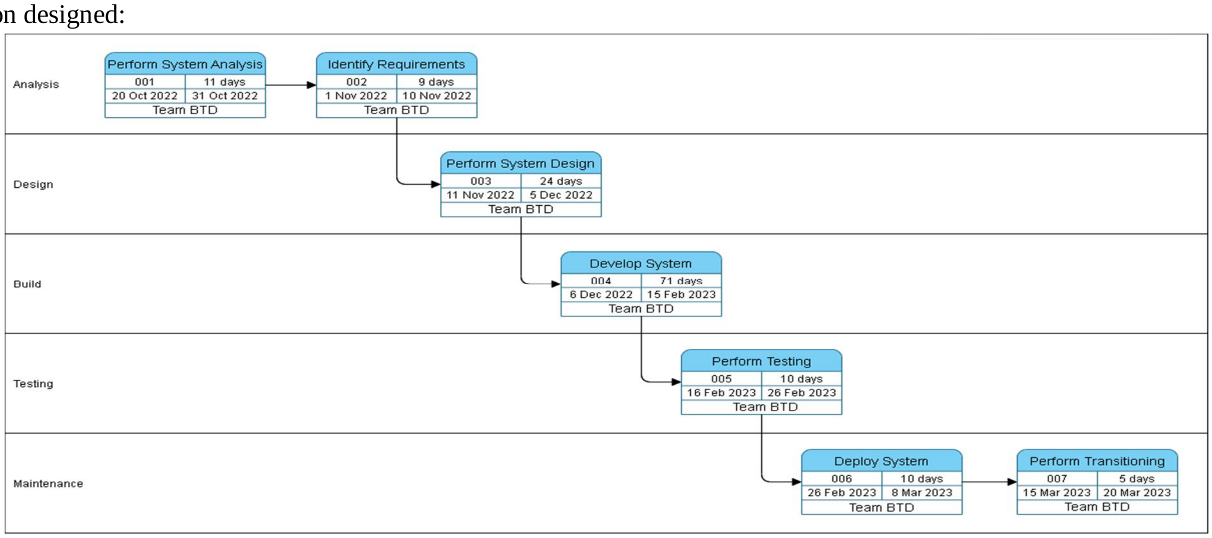


Figure 1. SDLC of Brain Tumor Detector.

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According to the above figure our SDLC is divided into 5 major phases Analysis, Design, Build, Testing, and Maintenance. We begin by performing system analysis, and next, we identify the requirements for developing the application and collected the dataset of various brain MRIs in image format. We collected all images with the help of radiologists, the internet, and also by clicking images on our own of MRI. So, we finally collected all the images and made a proper dataset according to various MRI images. This took a total of 20 days. In the next phase i.e. the Design phase, we perform the System Design using Figma (a tool for UI Design). Based on the requirements, we created a detailed design of the app. This included designing the architecture of the app, selecting appropriate technologies, and creating wireframes and mock-ups of the user interface. For designing the UI of the complete application, the team took a total of 24 days. In the next build phase, we coded the complete application from the scratch. For developing the system, a total of 71 days were required. We trained our CNN model by passing datasets. We trained our CNN model and its different layers so that it can detect efficiently. We trained our CNN model in python but we can't use it as it is in android so for that reason, we converted the CNN model into an android deployable file so we can use it in our application. In the next 10 days, we performed testing of the application. The testing of the application included various approaches such as Black Box Testing, White Box Testing, Unit Testing, Integration Testing, GUI Testing, and Performance Testing. After making sure there aren't any major bugs and defects in the system, we deployed the application which took us a total of 10 days. This time was used to understand the various system requirements of the users who might use the application and based on that study we deployed the application. In the remaining 5 days of time, Transitioning was performed.

## IV. MODULES

### *A. System Module*

The system module used for brain tumor detection is based on a deep learning model (CNN Model) that is designed to analyze brain MRI images and identify the presence of tumors. The CNN model is composed of multiple layers, each of which performs a specific operation on the input data.

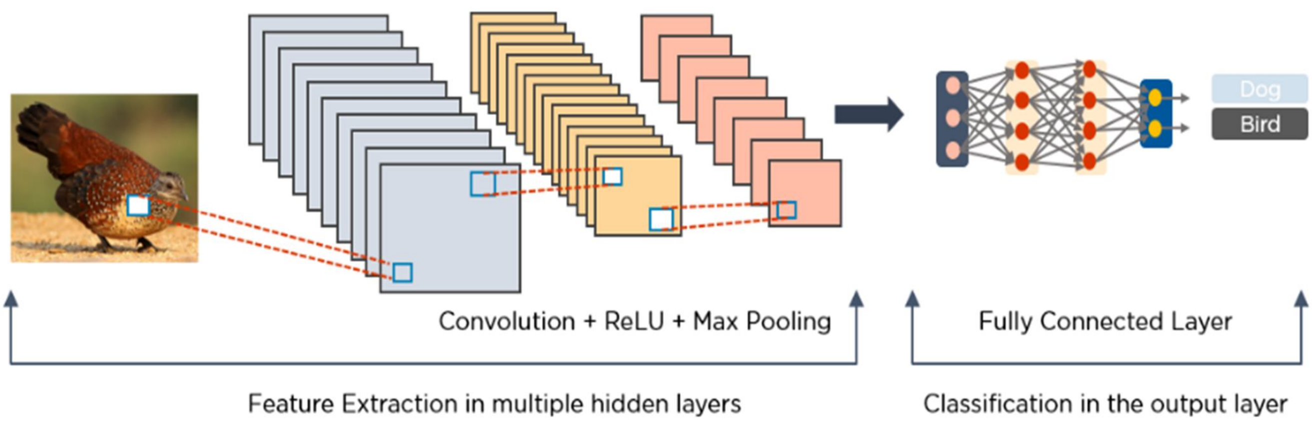


Figure 2. System Module of Brain Tumor Detector

When a brain MRI image is fed into the system module, it goes through a series of convolutions, pooling, and activation functions, which are designed to extract meaningful features from the image. These features are then passed to a fully connected layer, which uses them to make a binary classification decision - whether or not a tumor is present in the image.

The model used in the system module is trained using a large dataset of brain MRI images, where each image is labeled as either "tumor" or "no tumor". During training, the model adjusts its weights and biases to minimize the difference between its predicted output and the true label. This process is repeated multiple times until the model can accurately classify new, unseen brain MRI images.

After the model was trained successfully it was integrated into the system module and later this module was integrated into the Brain Tumor Detector application, where it can quickly and accurately analyze brain MRI images and provide clinicians with valuable information about the presence of tumors.

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## V. RESULTS

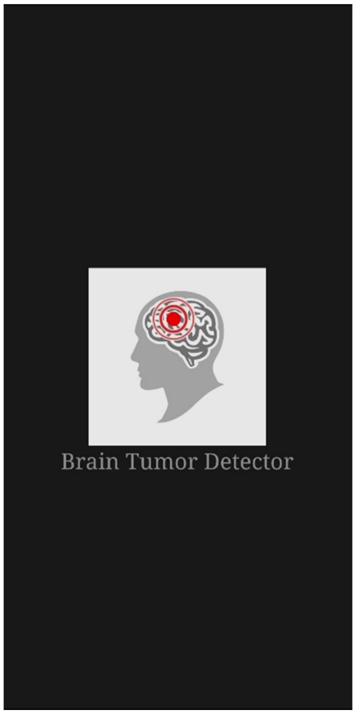


Fig 5.1.Startup Animation

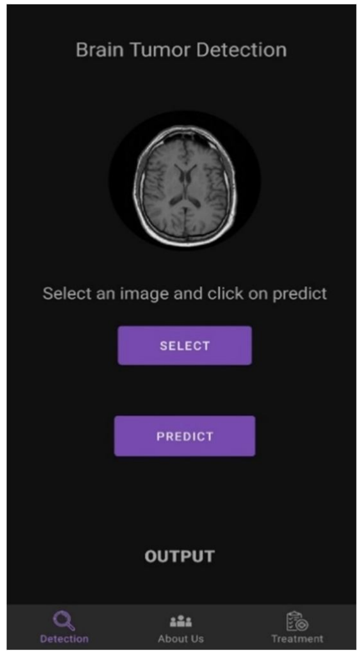


Fig 5.2.Home Screen

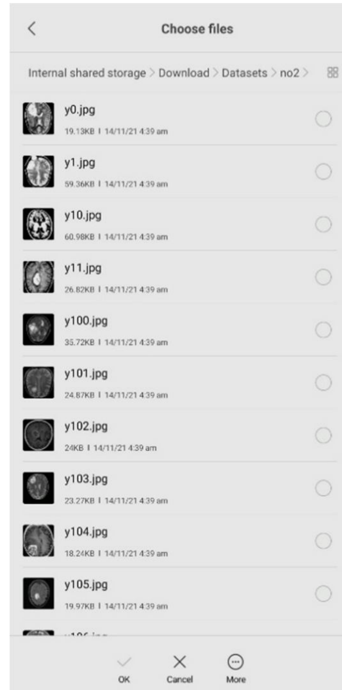


Fig 5.3.Image selection screen

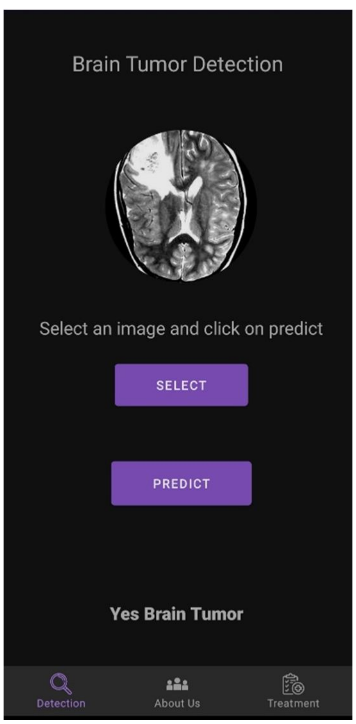


Fig 5.4.Post-detection screen

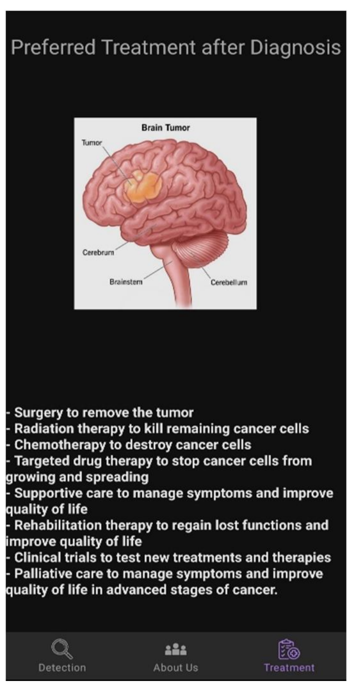


Fig 5.5.Preferred treatment screen

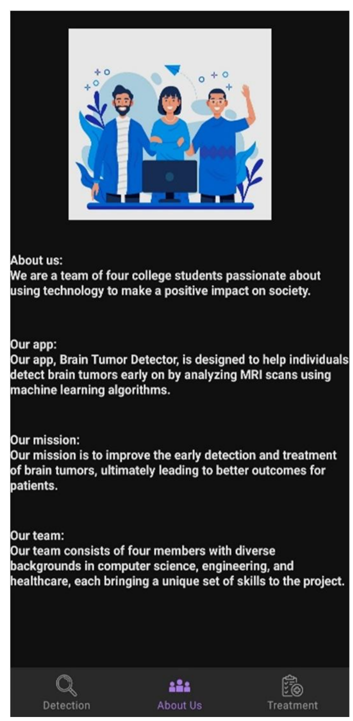


Fig 5.6.About us screen

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## VI. CONCLUSION

Our brain tumor detection app has demonstrated the potential to improve the accuracy and speed of detecting brain tumors from MRI images. The app provides an accessible and user-friendly tool for healthcare professionals to obtain accurate predictions of the presence of brain tumors. The use of a pre-trained CNN model fine-tuned on a large dataset of MRI images has resulted in high overall accuracy, sensitivity, and specificity, making the app a promising tool for assisting healthcare professionals in the diagnosis of brain tumors. With the increasing prevalence of brain tumors, the need for accurate and efficient detection tools is critical. Our app can be integrated into healthcare systems to improve the speed and accuracy of brain tumor detection, reducing the need for more invasive and time-consuming diagnostic procedures. Additionally, the app can help reduce the burden on healthcare professionals by automating the process of tumor detection, allowing them to focus on patient care and treatment. In summary, our brain tumor detection app shows promise as a valuable tool for improving the accuracy and speed of detecting brain tumors from MRI images. Further improvements and enhancements to the app could increase its usability and effectiveness, providing healthcare professionals with a reliable tool for diagnosing and treating brain tumors.

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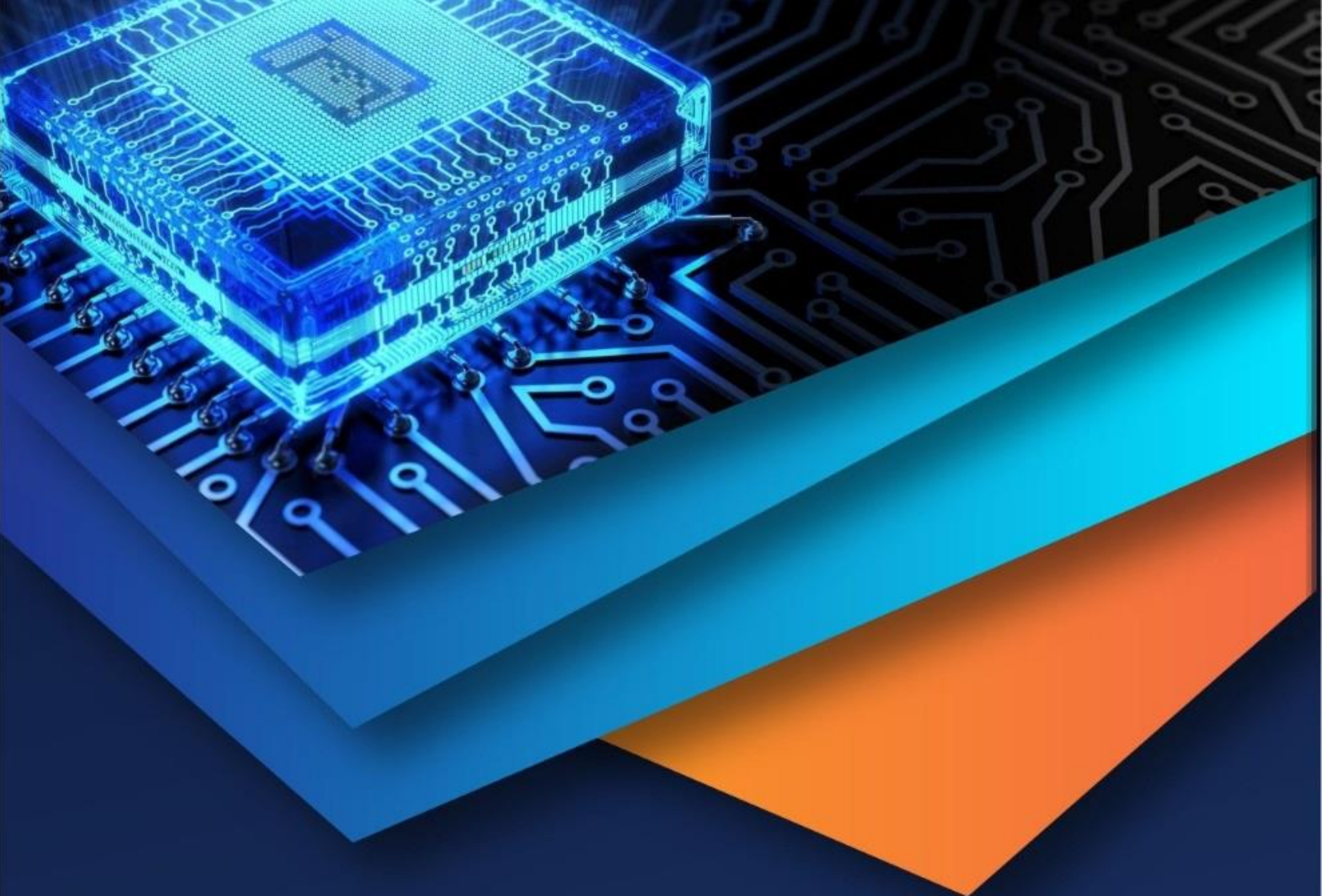


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