CHRIST
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# BRAIN TUMOR DETECTION USING DCNN


**Presented By:**
Purusharth Mallik
(234542)
Shilpee Maitra
(2348557)

1 MSAIM

**Guided By:**
Dr. Prabhu P

# Agenda

- Introduction to Brain Tumor Detection
- Deep Learning and Convolutional Neural Networks (CNNs)
- Dataset and Preprocessing
- CNN Architecture
- Xception
- Model Architecture
- Results and Accuracy

# Introduction to Brain Tumor Detection

1. **Definition of Brain Tumor**
   - A brain tumor is an abnormal growth of cells within the brain or the central spinal cord.
   - It can be benign (non-cancerous) or malignant (cancerous).
2. **Prevalence and Impact**
   - Brain tumors can affect individuals of all ages, including children and adults.
   - They can have severe neurological, cognitive, and physical consequences.
3. **Diagnostic Challenge**
   - Detecting brain tumors can be challenging due to their location and varying symptoms.
   - Early detection is crucial for effective treatment.
4. **Importance of Timely Detection**
   - Early detection can significantly improve treatment outcomes and patient survival rates.
   - Reduces the need for extensive and invasive procedures.
5. **Current Diagnostic Methods**
   - Traditional diagnostic methods include CT scans, MRI, and biopsy.
   - These methods may have limitations in terms of cost, accessibility, and speed.
6. **Role of Deep Learning**
   - Deep learning, specifically Convolutional Neural Networks (CNNs), offers a promising approach for accurate and timely brain tumor detection.

# Deep Learning and Convolutional Neural Networks

- **Deep Learning**: Deep Learning is a subfield of machine learning that focuses on the use of artificial neural networks with multiple layers to model and solve complex tasks. It is inspired by the structure and function of the human brain and has shown remarkable success in various domains, including image and speech recognition, natural language processing, and healthcare.

- **Convolutional Neural Networks (CNNs)**: CNNs are a specific type of deep neural network designed for processing structured grid data, such as images and videos. They are particularly powerful for tasks involving feature extraction and pattern recognition in visual data. CNNs use convolutional layers to automatically learn hierarchical features from input data, making them well-suited for tasks like image classification, object detection, and, as in this presentation, brain tumor detection in medical images.

# Dataset and Preprocessing

Dataset -> Image Dataset of various types of Brain Tumor

Preprocessing Pipeline:

1. Resizing the image
2. Increasing the brightness of the pixels
3. Converting the images into grayscale
4. Applying a region filling filter on the image

# CNN Architecture

- **Key Components of CNN Architecture:**
  1. **Convolutional Layers:**
     - Responsible for feature extraction through convolution operations.
     - Apply learnable filters to input images, preserving spatial relationships.
  2. **Pooling Layers (Subsampling):**
     - Reduce spatial dimensions of feature maps.
     - Improve computational efficiency and reduce overfitting.
  3. **Fully Connected Layers (Dense Layers):**
     - Flatten feature maps into vectors.
     - Perform classification based on extracted features.
  4. **Activation Functions (e.g., ReLU):**
     - Introduce non-linearity into the model.
     - Enable learning complex patterns and features.
  5. **Batch Normalization:**
     - Normalize activations to improve training stability.
     - Accelerate convergence and prevent vanishing/exploding gradients.
  6. **Dropout:**
     - Regularization technique to reduce overfitting.
     - Randomly deactivate neurons during training to encourage robustness.

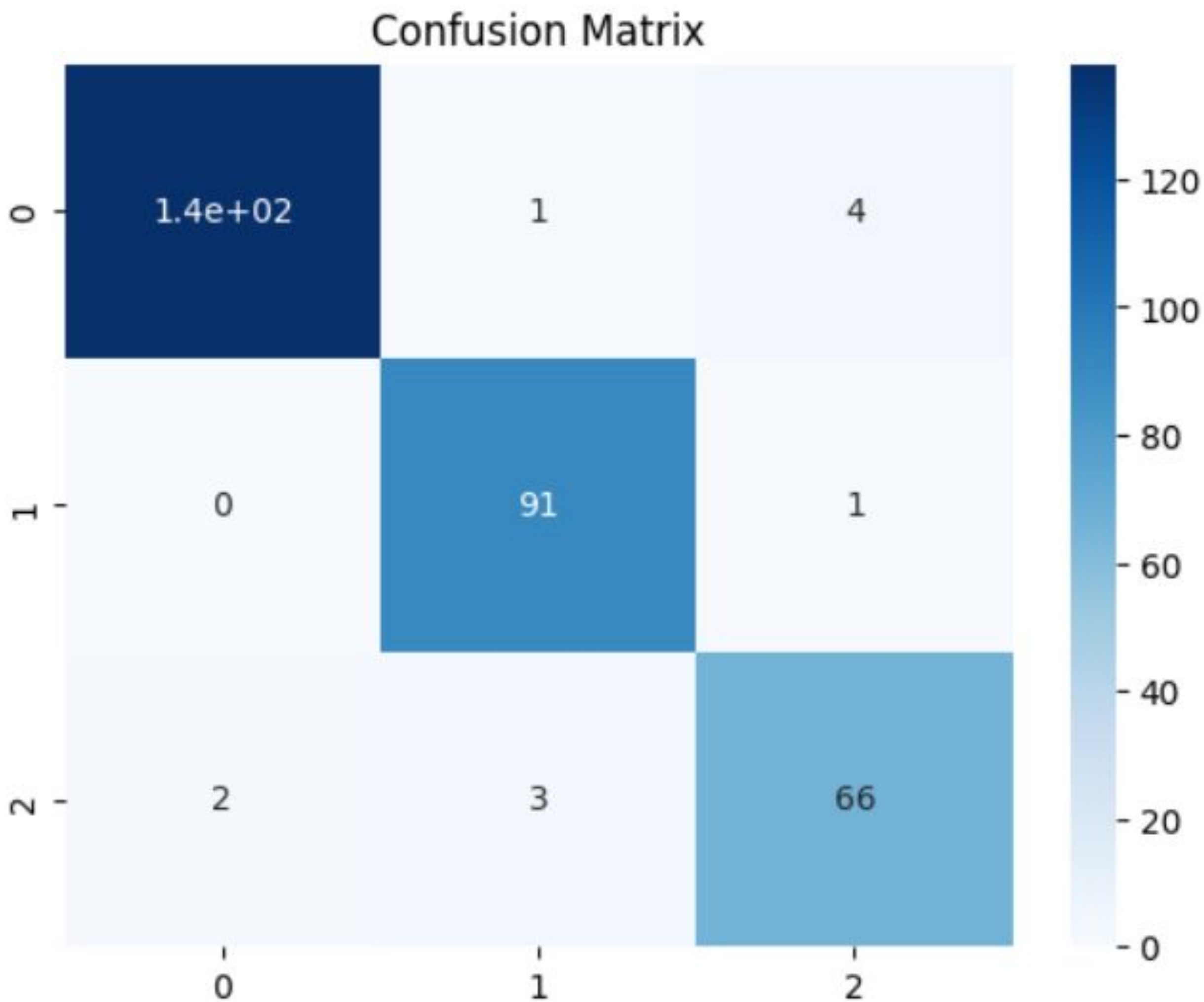
# Xception

- Xception stands for "Extreme Inception," and it's a deep convolutional neural network architecture.
- It was introduced by Francois Chollet in 2016 as an evolution of the Inception architecture, aiming to improve the efficiency and accuracy of deep learning models for image classification tasks.
- Xception replaces the traditional Inception modules with depthwise separable convolutions, which decouple spatial and channel-wise convolutions, reducing computational complexity.
- This architecture achieves state-of-the-art performance on various image classification benchmarks while being computationally efficient, making it suitable for applications with limited resources.
- Xception's success has influenced subsequent neural network architectures and remains a prominent choice in the field of computer vision and deep learning.

# Model Architecture

```
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 xception (Functional)       (None, 2048)              20861480

 batch_normalization_4 (Batc  (None, 2048)             8192
 hNormalization)

 dense (Dense)               (None, 256)               524544

 dropout (Dropout)           (None, 256)               0

 dense_1 (Dense)             (None, 3)                 771

=================================================================
Total params: 21,394,987
Trainable params: 21,336,363
Non-trainable params: 58,624
_________________________________________________________________
```

# Results and Analysis



# Conclusion

The model gives F-0 score greater than 96% which is not state-of-the-art considering we are talking about people’s lives here. However, given the limited resources and computational powers, it can be considered as a very good base model to build upon.