MRI Brain Tumor Survival Prediction

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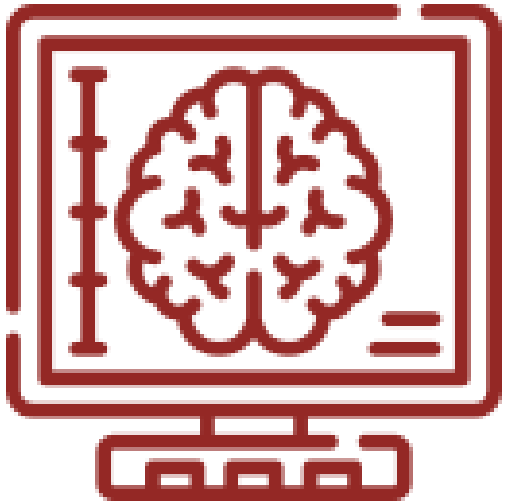
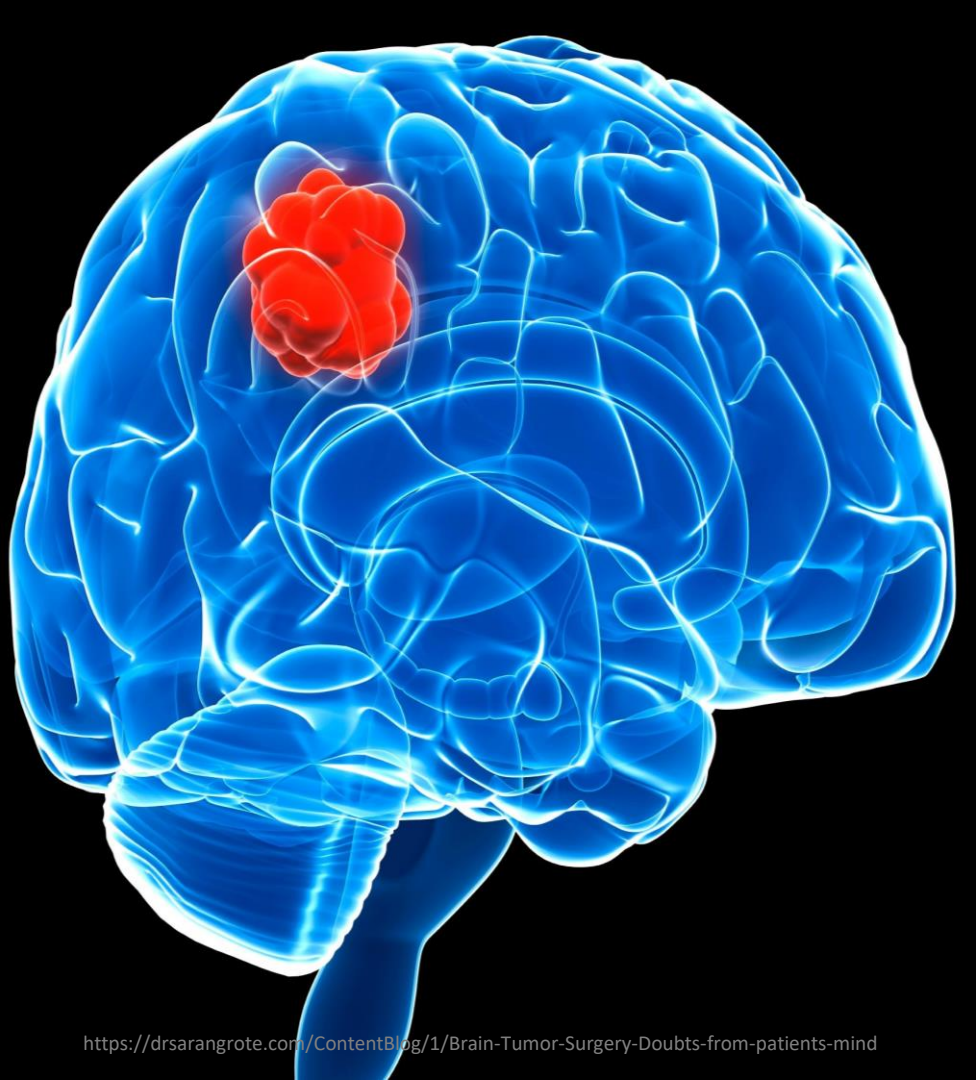



https://drsarangrote.com/ContentBlog/1/Brain-Tumor-Surgery-Doubts-from-patients-mind

Background

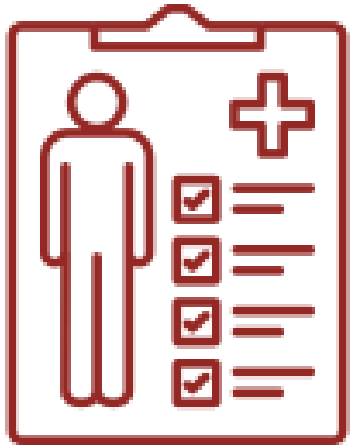
Brain tumors, as a highly malignant form of tumors, do not have a favorable survival rate for patients.

MRI can quickly and clearly capture details of brain tissue.

Magnetic Resonance Imaging (MRI) involves placing the human body in a high magnetic field environment, using radio waves to excite the hydrogen atoms inside the body, generating resonance signals, and obtaining images through computer software calculations.

Research problem

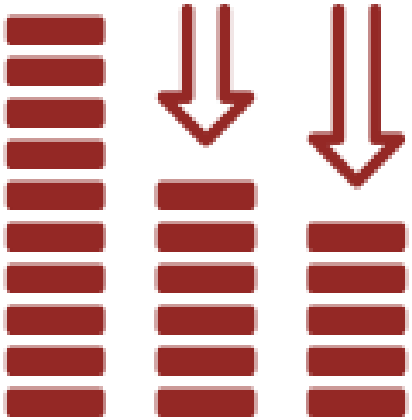
Directly reading MRI images **only allows for rough estimates** of the survival time of brain tumor patients, which is not conducive to treatment planning.



Extracting feature information from brain tumor images to predict a patient's survival time can help doctors **develop more targeted treatment plans**.

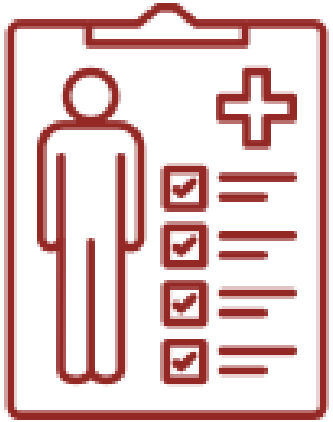
Gap

Low accuracy of
current survival prediction models

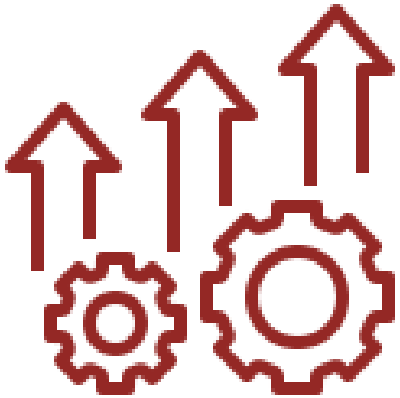


Lack of survival data

Research aim



Using the BraTS'20 dataset, we want to focus on the **prediction of overall patient survival**.

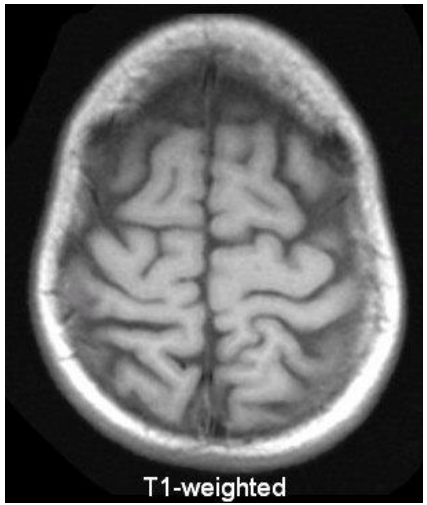


Improve the performance by **adding additional features** such as radiological signatures and spatial habitat.

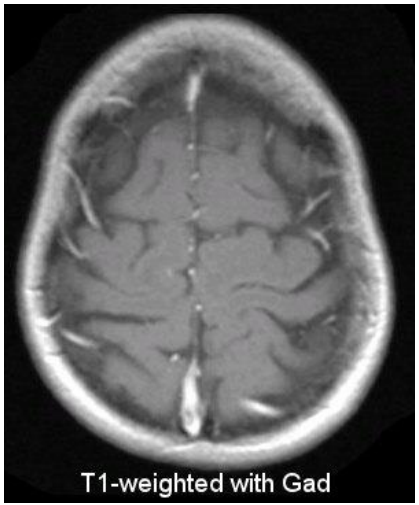
BraTS

Full name	Brain Tumor Segmentation Challenge
Main goal	Advance the latest multimodal MRI methods to achieve more accurate brain tumor segmentation
Benefits	Assist in medical diagnosis and treatment planning
Data format	BraTS'20 dataset contains： 4 types of MRI images (N = 369)：NIfTI files Other survival data (N = 232)：CSV files

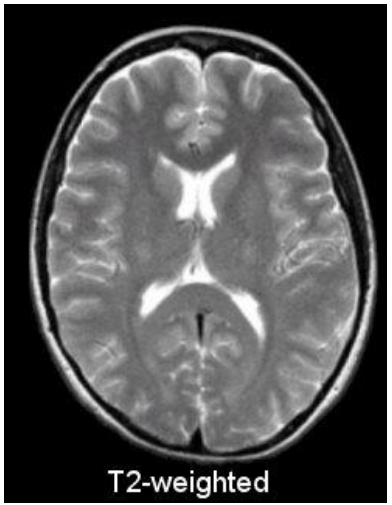
MRI images



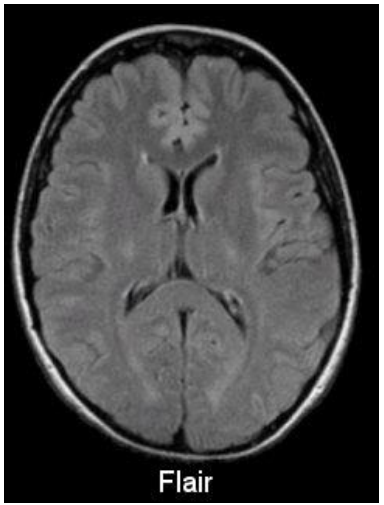
Fat appears as bright



Enhances contrast

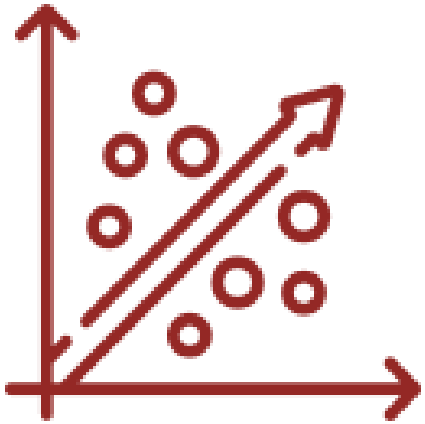


Water and liquid tissues appear as bright

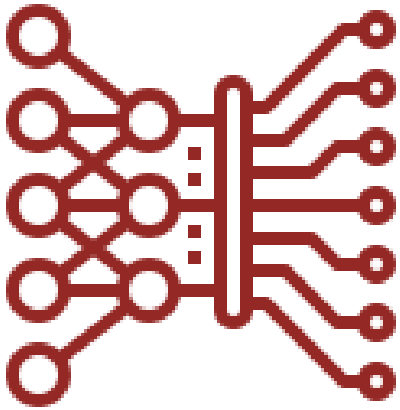


Non-liquid tissues appear as bright

Method

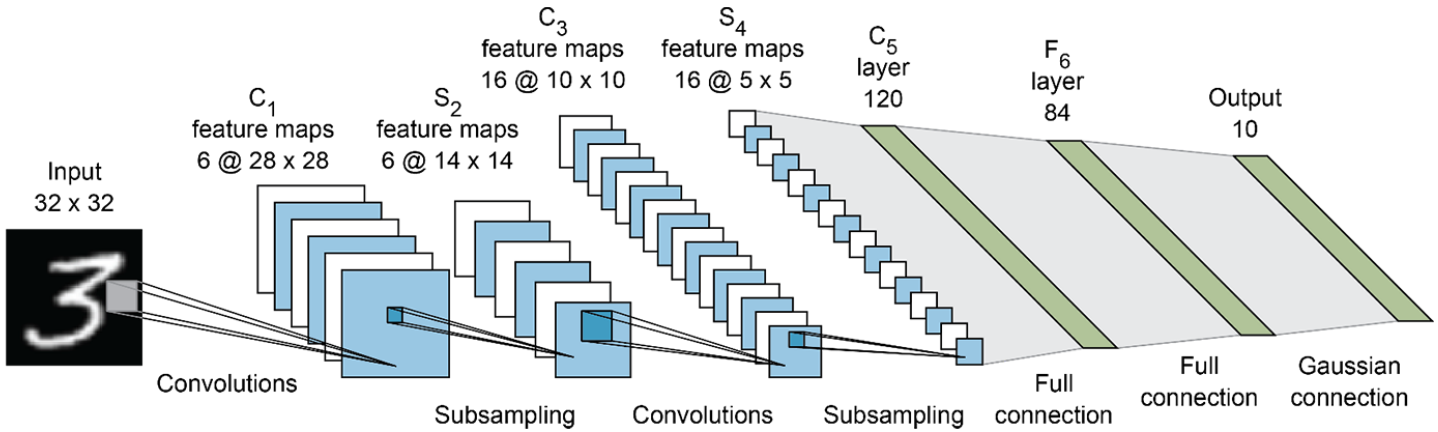


We will use the **BraTS'20** dataset and due to lack of dataset we will apply **transfer learning** to solve the problem and perform **regression** to predict days to survive.



We will use **machine learning and deep learning** to make predictions on the data and try to improve the accuracy of the model by **incorporating additional features** such as radiometric and spatial features.

Method : CNN

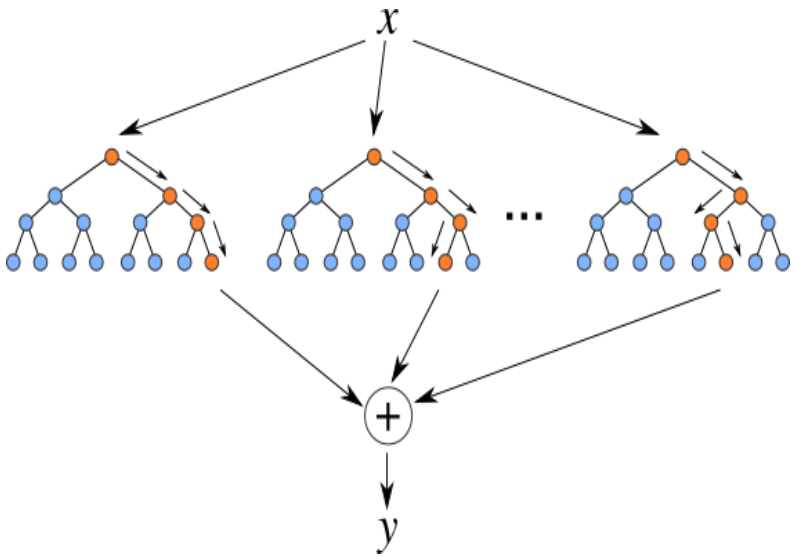


Convolutional neural network (CNN) is a deep learning method with a three-layer structure : convolution layer, pooling layer and fully connected layer.

In the convolutional layer , the image is operated according to a custom filter matrix. This allows for a **gradual reduction** in image size, thereby **producing feature maps** while preserving image's characteristics.

05_01.png (1400×412) (drek4537l1klr.cloudfront.net)

Method：Random Forest

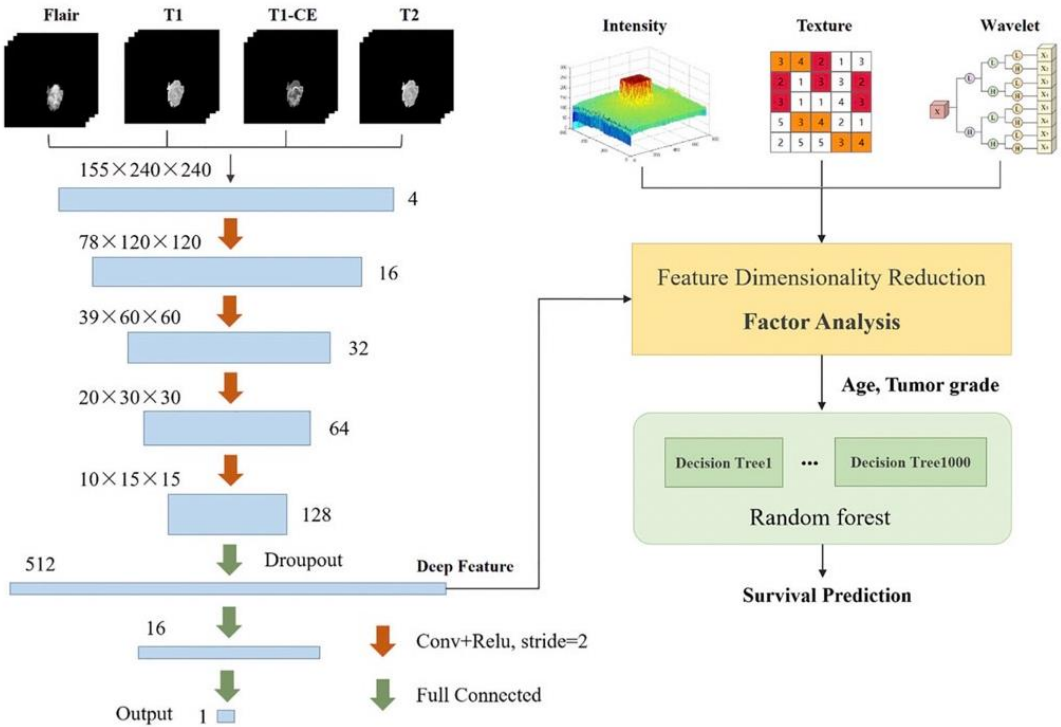


Random Forest is a kind of machine learning algorithm which can be used to **solve regression and classification problems**.

It can ensemble lots of decision trees to improve the accuracy and the robustness of the model.

Random Forest Regression. Random Forest Regression is a… | by Chaya | Level Up Coding (gitconnected.com)

Method



Huang H, Zhang W, Fang Y, Hong J, Su S, Lai X. Overall Survival Prediction for Gliomas Using a Novel Compound Approach. Front Oncol. 2021 Aug 18;11:724191. doi: 10.3389/fonc.2021.724191. PMID: 34490121; PMCID: PMC8416476.

Summary

Overall aim

Focus on the prediction of patient overall survival and try to improve performance

Deal with small data size

Apply transfer learning to solve the problem

Improve accuracy

Add new features or do feature selection

Thanks for listening