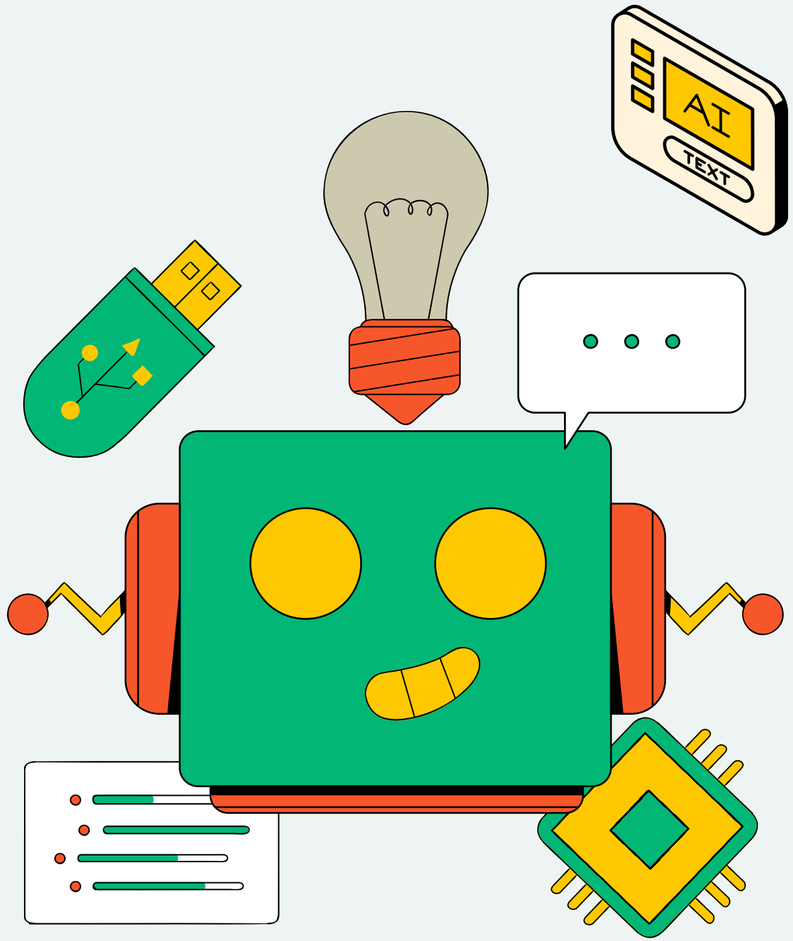

EMERGING AI TECHNOLOGIES GROUP ASSIGNMENT

PRESENTED BY:

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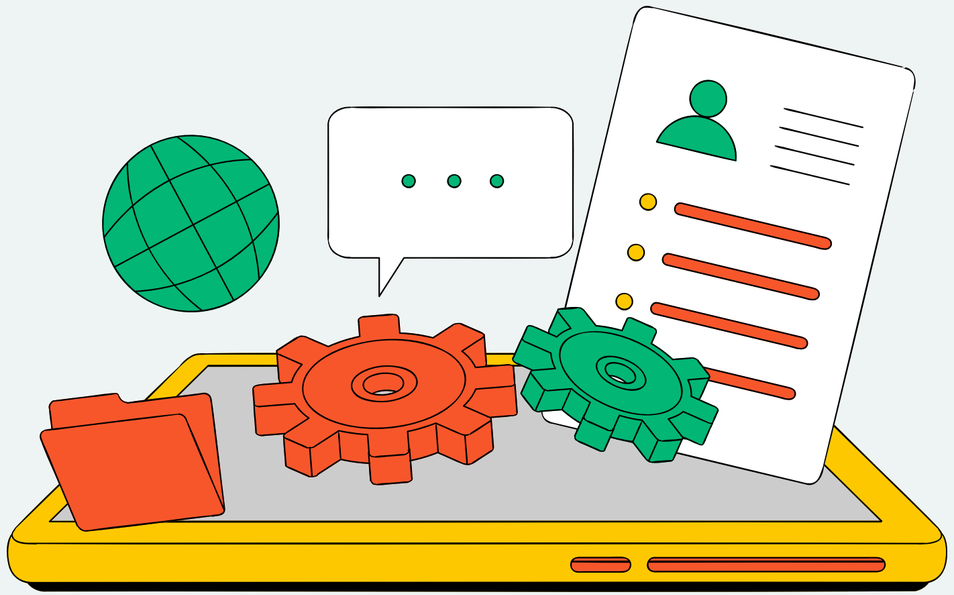
1.PROBLEM STATEMENT



PROBLEM STATEMENT

1.1 CONTEXT

In the realm of healthcare, the timely diagnosis of ocular diseases is crucial for effective treatment and patient well-being. However, the diagnostic process often faces challenges due to the presence of various types of ocular diseases and the need for accurate and timely detection. To address this issue, our project focuses on developing a binary classification model using machine learning techniques.

1.2 PURPOSE

- The primary goal of our project is to streamline the diagnostic process for ocular diseases by creating a binary classification model.
- Our dataset contains diverse types of ocular diseases, but for the purpose of this project, we will group them into one category for binary classification.
- Timely detection of ocular diseases is essential to improve patient outcomes, and our objective is to leverage advanced algorithms to enhance diagnostic accuracy and speed.

1.3 SOLUTION

To accomplish our objective, we'll leverage the capabilities of Automated Machine Learning (AutoML) alongside advanced convolutional neural network architectures like ResNet and VGG (Visual Geometry Group).

The TPOT (Tree-based Pipeline Optimization Tool) classifier into this amalgam, our project aims to revolutionize ocular healthcare. This holistic integration ensures not only meeting the contemporary healthcare demands but also establishing a new benchmark for the efficiency and effectiveness of ocular disease detection.

2. RESEARCH

2.1 RESEARCH PAPER -1

Deep Residual Learning for Image Recognition

Background: comprehensive empirical evidence showing that these residual networks are easier to optimize, and can gain accuracy from considerably increased depth.

HTTPS://PAPERSWITHCODE.COM/PAPER/DEEP-RESIDUAL-LEARNING-FOR-IMAGE-RECOGNITION

Objective :The depth of representations is of central importance for many visual recognition tasks.

Deep Residual Learning for Image Recognition

CVPR 2016 · Kaiming He, Xiangyu Zhang, Shaoqing Ren, Jian Sun · Edit social preview

Deeper neural networks are more difficult to train. We present a residual learning framework to ease the training of networks that are substantially deeper than those used previously. We explicitly reformulate the layers as learning residual functions with reference to the layer inputs, instead of learning unreferenced functions. We provide comprehensive empirical evidence showing that these residual networks are easier to optimize, and can gain accuracy from considerably increased depth. On the ImageNet dataset we evaluate residual nets with a depth of up to 152 layers---8x deeper than VGG nets but still having lower complexity. An ensemble of these residual nets achieves 3.57% error on the ImageNet test set. This result won the 1st place on the ILSVRC 2015 classification task. We also present analysis on CIFAR-10 with 100 and 1000 layers. The depth of representations is of central importance for many visual recognition tasks. Solely due to our extremely deep representations, we obtain a 28% relative improvement on the COCO object detection dataset. Deep residual nets are foundations of our submissions to ILSVRC & COCO 2015 competitions, where we also won the 1st places on the tasks of ImageNet detection, ImageNet localization, COCO detection, and COCO segmentation.

2.2 RESEARCH PAPER -2

Transfer Learning based Detection of Diabetic Retinopathy from Small Dataset

background: Transfer Learning based Detection of Diabetic Retinopathy from Small Dataset

Objective: to implement transfer learning is to classify DR into 2 classes with a much reduced training data than other previous DR classification techniques employed.

HTTPS://PAPERSWITHCODE.COM/PAPER/TRANSFER-LEARNING-BASED-DETECTION-OF-DIABETIC

Transfer Learning based Detection of Diabetic Retinopathy from Small Dataset

17 May 2019 · Misgina Tsighe Hagos, Shri Kant · Edit social preview

Annotated training data insufficiency remains to be one of the challenges of applying deep learning in medical data classification problems. Transfer learning from an already trained deep convolutional network can be used to reduce the cost of training from scratch and to train with small training data for deep learning. This raises the question of whether we can use transfer learning to overcome the training data insufficiency problem in deep learning based medical data classifications. Deep convolutional networks have been achieving high performance results on the ImageNet Large Scale Visual Recognition Competition (ILSVRC) image classification challenge. One example is the Inception-V3 model that was the first runner up on the ILSVRC 2015 challenge. Inception modules that help to extract different sized features of input images in one level of convolution are the unique features of the Inception-V3. In this work, we have used a pretrained Inception-V3 model to take advantage of its Inception modules for Diabetic Retinopathy detection. In order to tackle the labelled data insufficiency problem, we sub-sampled a smaller version of the Kaggle Diabetic Retinopathy classification challenge dataset for model training, and tested the model's accuracy on a previously unseen data subset. Our technique could be used in other deep learning based medical image classification problems facing the challenge of labeled training data insufficiency.

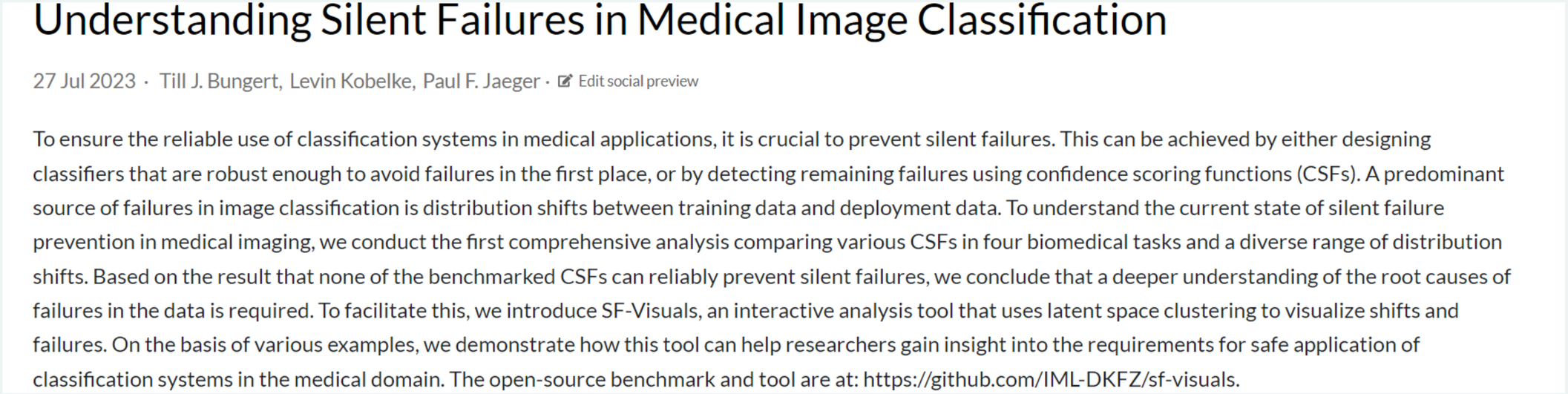
2.3 RESEARCH PAPER-3

Understanding Silent Failures in Medical Image Classification

Background: To ensure the reliable use of classification systems in medical applications, it is crucial to prevent silent failures.

Objective: To progress towards reliable ML systems, a deeper understanding of the data itself is required. SF-Visuals can help to bridge this gap and equip researchers with a better intuition of when and how to employ ML systems for a particular task

HTTPS://PAPERSWITHCODE.COM/PAPER/UNDERSTANDING-SILENT-FAILURES-IN-MEDICAL

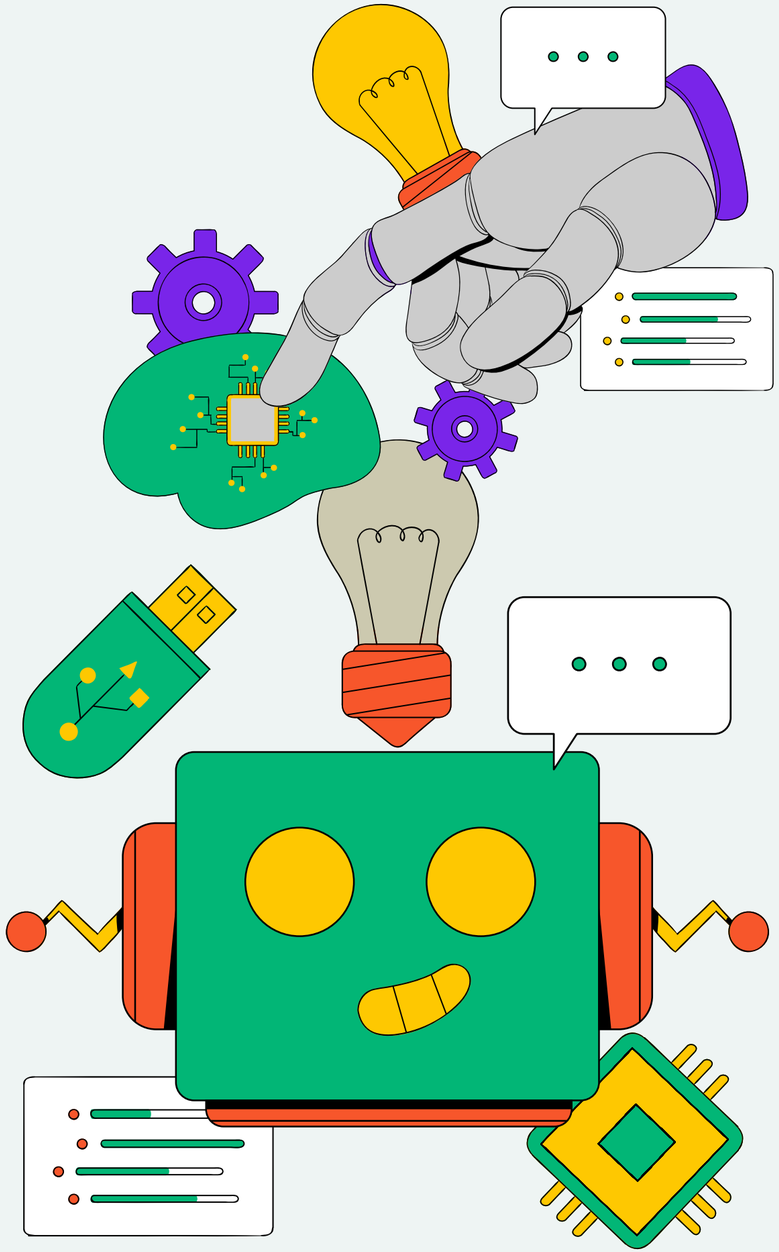


Understanding Silent Failures in Medical Image Classification

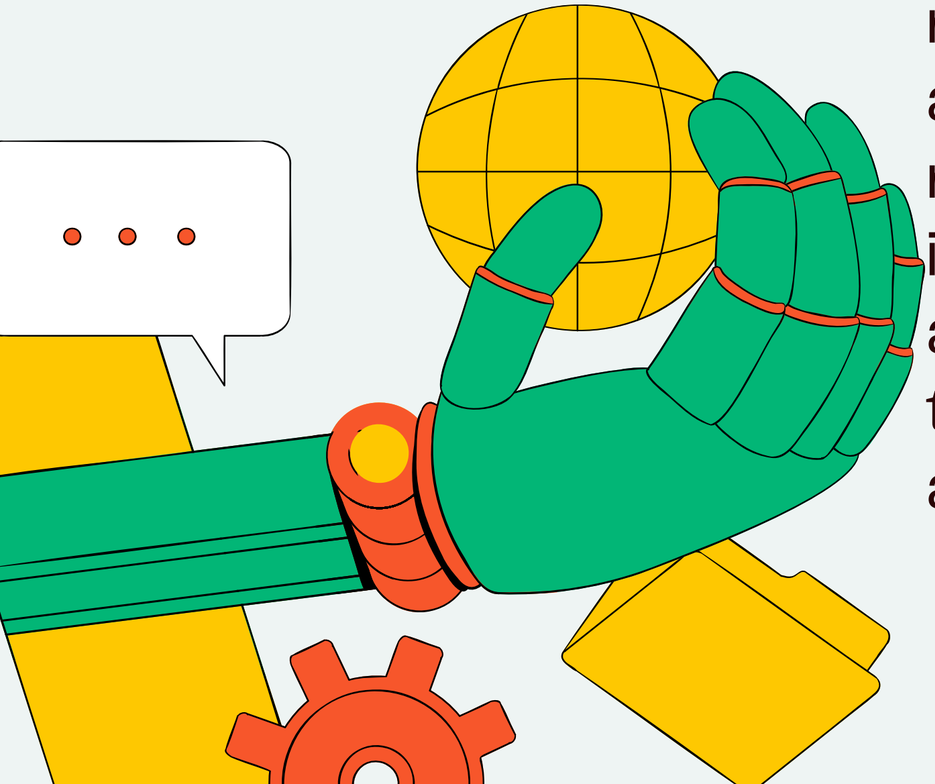
27 Jul 2023 · Till J. Bungert, Levin Kobelke, Paul F. Jaeger · Edit social preview

To ensure the reliable use of classification systems in medical applications, it is crucial to prevent silent failures. This can be achieved by either designing classifiers that are robust enough to avoid failures in the first place, or by detecting remaining failures using confidence scoring functions (CSFs). A predominant source of failures in image classification is distribution shifts between training data and deployment data. To understand the current state of silent failure prevention in medical imaging, we conduct the first comprehensive analysis comparing various CSFs in four biomedical tasks and a diverse range of distribution shifts. Based on the result that none of the benchmarked CSFs can reliably prevent silent failures, we conclude that a deeper understanding of the root causes of failures in the data is required. To facilitate this, we introduce SF-Visuals, an interactive analysis tool that uses latent space clustering to visualize shifts and failures. On the basis of various examples, we demonstrate how this tool can help researchers gain insight into the requirements for safe application of classification systems in the medical domain. The open-source benchmark and tool are at: https://github.com/IML-DKFZ/sf-visuals.

3.HYPOTHESIS / PROPOSAL



3.1 - INTRODUCTION TO AUTOML



Automated machine learning, or AutoML, refers to the automation of the entire process involved in constructing machine learning models. It encompasses a range of methods and procedures designed to democratize machine learning, making it accessible to individuals without expertise in the field. By automating various tasks, AutoML enhances the efficiency of machine learning processes and accelerates research in the field.

3.2 TPOT CLASSIFICATION

TPOT

TPOT (TREE-BASED PIPELINE OPTIMIZATION TOOL) IS AN AUTOMATED MACHINE LEARNING (AUTOML) TOOL. IT AUTOMATES THE PROCESS OF MACHINE LEARNING PIPELINE CREATION, INCLUDING FEATURE SELECTION, FEATURE PREPROCESSING, MODEL SELECTION, AND HYPERPARAMETER OPTIMIZATION. TPOT USES GENETIC ALGORITHMS TO SEARCH THROUGH A WIDE RANGE OF POSSIBLE PIPELINES AND SELECTS THE BEST-PERFORMING ONE BASED ON A SPECIFIED EVALUATION METRIC.

3.3 PROTOTYPE

This dataset has several types of diseases, however, this project will group all those diseases into one category, because this problem is going to be fixed using binary classification

Model Training with TPOT Classification

- **Best Model:** "RESNET"
- **ACCURACY: 0.640625**

Thanks you!