CSE499B.6 Presentation

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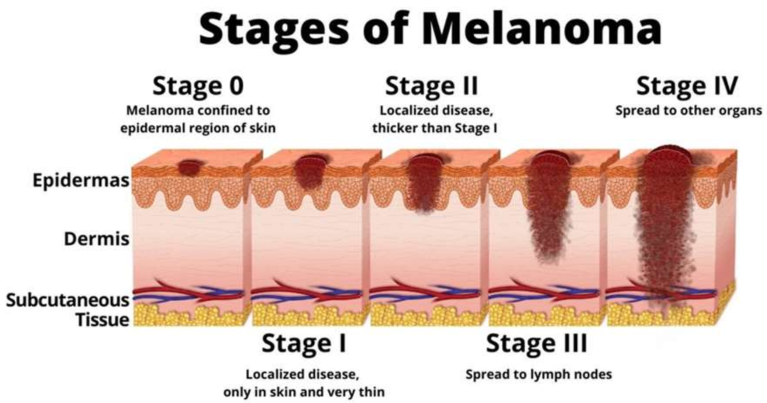
Melanoma Classification Using Deep Learning Techniques

What is Melanoma?

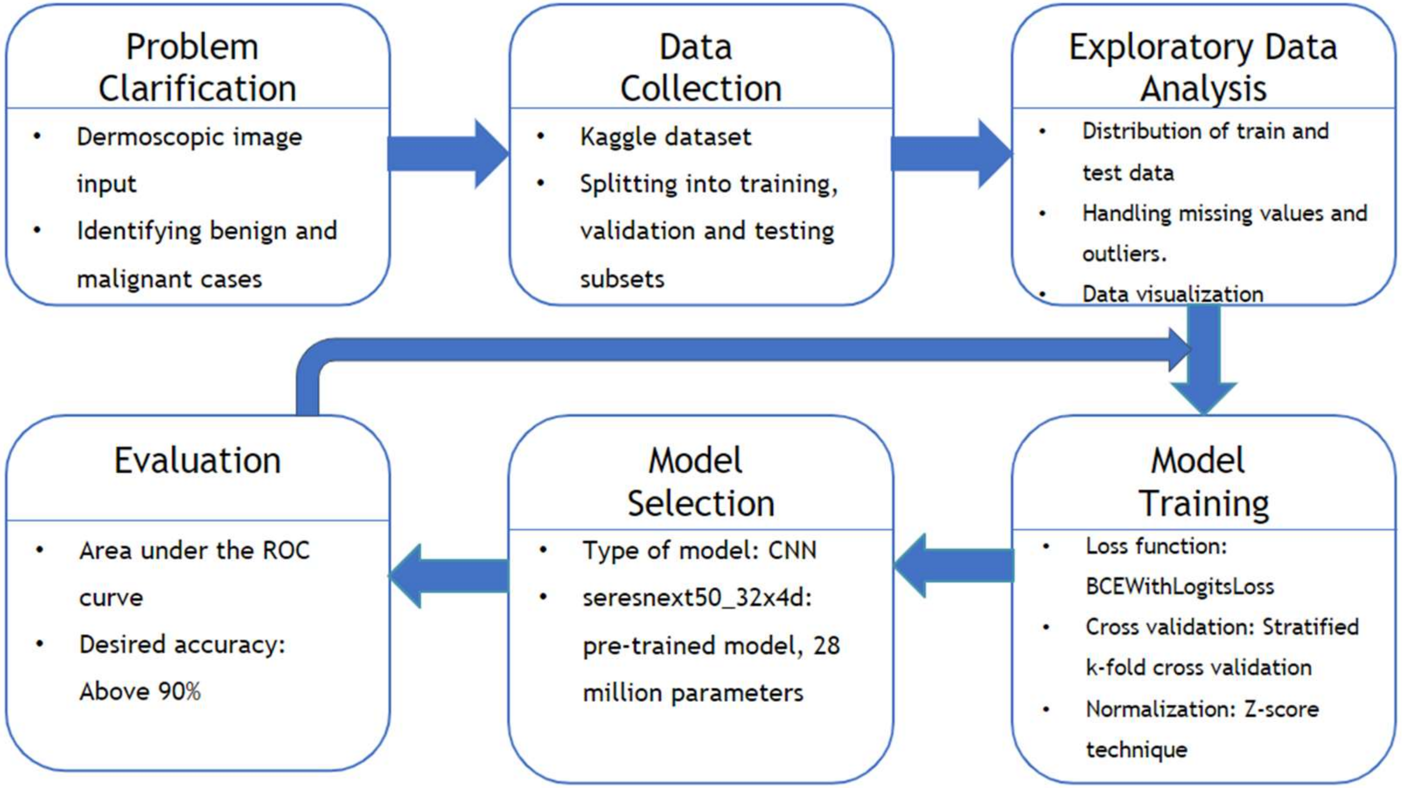
Melanoma is a type of skin cancer that develops from the pigment-producing cells known as melanocytes. It is the most dangerous type of skin cancer. In 2015, 3.1 million people had active disease, which resulted in 59,800 deaths.



Goal

To correctly identify the benign and malignant cases. The model should predict the probability between 0.0 and 1.0 that the lesion in the image is malignant (the target)

System Design



Usability Testing & Manufacturability

Automated Testing

Unit Testing: Individual units of source code—sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures—are tested to determine whether they are fit for use.

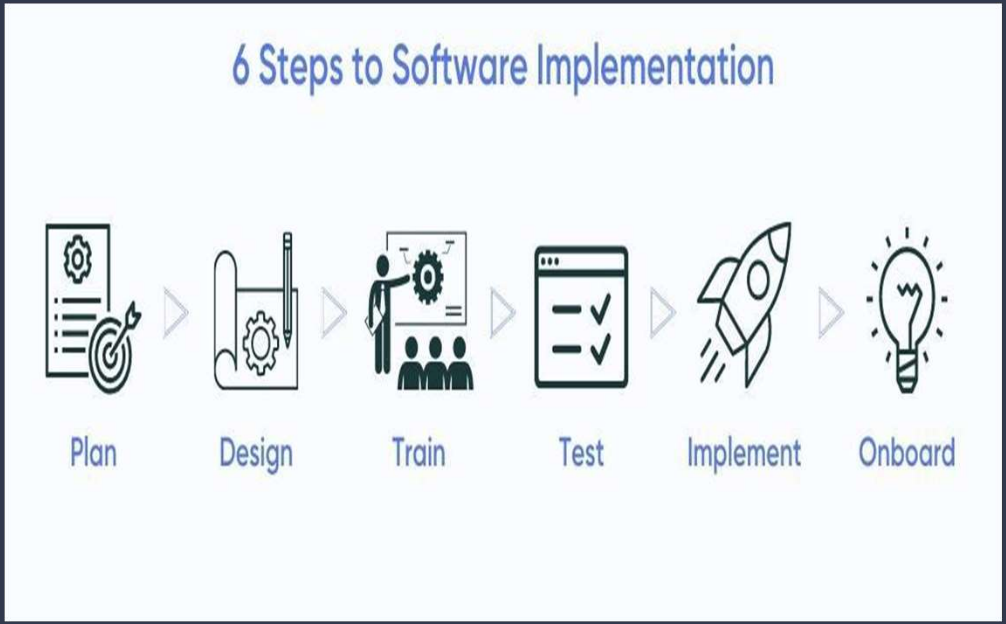
Model Performance Testing: Entails comparing the model's performance in terms of precision-recall and F-score to that of a predetermined accuracy with which the model has previously been constructed and placed into production.

Design for Manufacturability

Designing products to optimize their manufacturing ease and production cost given form, fit, and function requirements. Applications include:

- Comparing design alternatives to understand which one has the fewest manufacturability issues and is least expensive to produce.
- Identifying design features that unnecessarily drive requirements for additional manufacturing operations or negatively impact sustainability initiatives.

Implementation



- **Plan:** Includes total costs, name of the tools, timeline, required preparation, possible obstacles, suggested solutions
- **Design:** Clear idea of steps, choosing the right team, setting thresholds and benchmarks and creating a checklist
- **Train:** Training the team includes meetings, an interactive presentation, virtual calls etc.
- **Test:** Before the launch to pinpoint problems, bugs and major issues; after the launch monitoring and maintenance
- **Implement:** Factors to consider - end user's experience, test results and number of implemented feature
- **Onboard:** Includes interaction, in app messages and announcements, pop-ups and hotspots

Development Process

Agile Software Development

Agile practices include requirements discovery and solutions improvement through the collaborative effort of self-organizing and cross-functional teams with their customer(s)/end user(s) adaptive planning, evolutionary development, early delivery, continual improvement, and flexible responses to changes in requirements, capacity, and understanding of the problems to be solved.

Environmental Sustainability

Carbon Footprint

AI-based systems require a lot of processing power. They must handle a large amount of data, which increases the demand for servers and the reliance on electricity to keep data centers cool. We'll partner with any cloud provider that is dedicated to lowering its carbon footprint, hence lowering ours. Our AI training and processing can be outsourced to a data center cloud provider.

Error Minimization

When humans make mistakes while performing manual activities, the work must frequently be evaluated and redone. More energy is consumed as a result of treating these preventable issues. Our project has the potential to reduce human error.

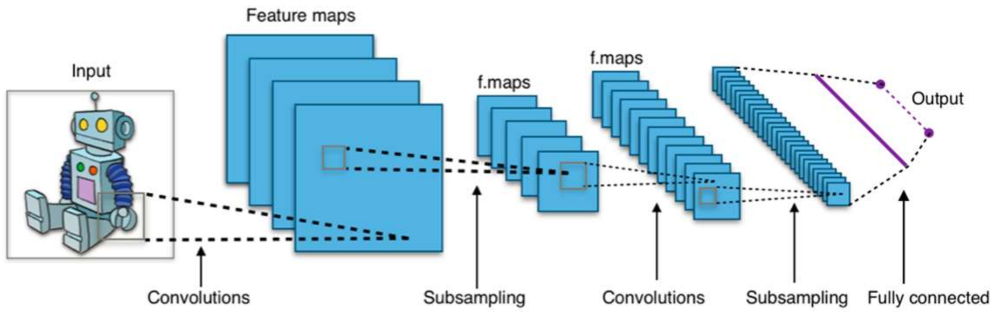
Increased Productivity

We can produce more efficient operations and save energy. In addition, our project can be used to help re-engineer processes, removing redundant stages from the present process.

Tools & Technologies Used

- Google Colab for team collaboration and cloud GPU
- Kaggle for Melanoma dataset and Google Drive for storing the dataset
- Github for development and version control
- Python programming language and Pytorch framework
- Pretrained model: SEResNext50_32x4d
- Python libraries: torch, numpy, pandas, albumentations, PIL, turtle, scikit-learn, tqdm
- Python packages: joblib, wtfml

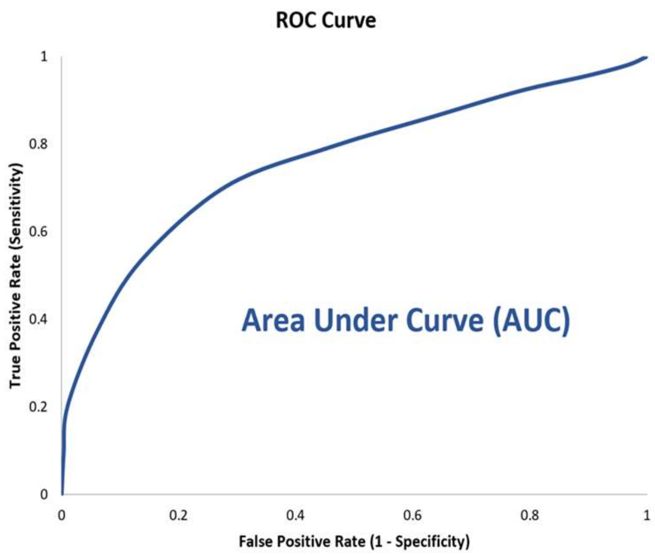
- Convolutional Neural Network (CNN) to analyze visual imagery. They are based on the shared-weight architecture of the convolution kernels or filters that slide along input features and provide translation-equivariant responses known as feature maps.



Result

Evaluation metric

AUC (Area under the ROC curve) measures the entire two-dimensional area underneath the entire ROC curve from (0,0) to (1,1). The curve is created by plotting the true positive rate (TPR) against the false positive rate (FPR) at various threshold settings. The true-positive rate is also known as sensitivity, recall or probability of detection. The false-positive rate is also known as probability of false alarm and can be calculated as (1 – specificity)



Accuracy

Total number of epoch was 50. The highest accuracy achieved was 90%.