Neural Network Classification of Colon Cancer Histopathological Images

Presentation Outline

1. Problem
2. Data
3. Modeling
4. Recommendation
5. Next Steps

Problem

- Colon cancer is the #3 most common cancer in US[1]
- 19 million colonoscopies are performed each year in the US[2]
- It can take 2-3 days to get biopsy results[3]
- Although tests aren't 100% accurate all the time, false positives and false negative results are very low. Generally is thought to occur in 1 to 2% of surgical pathology cases[4]

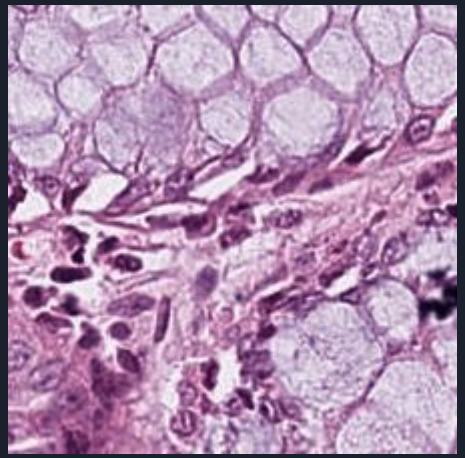
1. Centers for Disease Control and Prevention. (2021, June 8). Colorectal cancer statistics. Centers for Disease Control and Prevention. https://www.cdc.gov/cancer/colorectal/statistics/index.htm
2. iData Research. (2018, August 8). An astounding 19 Million colonoscopies are performed annually in The United States. iData Research. https://idataresearch.com/an-astounding-19-million-colonoscopies-are-performed-annually-in-the-united-states/#:~:text=An Astounding 19 Million Colonoscopies are Performed Annually in The United States,-08%2F08%2F2018.
3. Reasons for delays in getting your biopsy and cytology test results. American Cancer Society. (n.d.). https://www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer/how-long-does-testing-take.html.
4. LeVea, C. (n.d.). Can a cancer biopsy result be wrong? Roswell Park Comprehensive Cancer Center. https://www.roswellpark.org/cancertalk/202010/can-cancer-biopsy-result-be-wrong.

Data

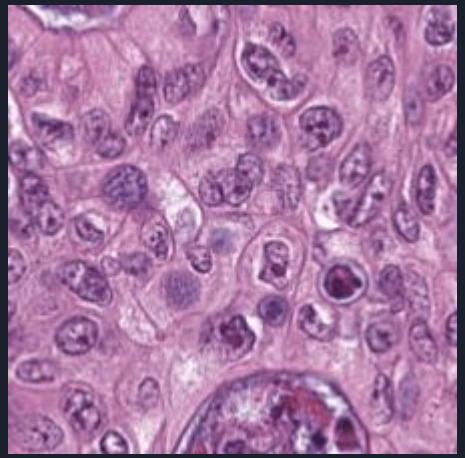
- Zenodo dataset
- Whole dataset: 100,000 images
    - 9 classes separated by a subdirectory
- TUM (cancer cells): 14,317 images
- NORM (normal cells): 8,763 images
- Image size: Standard 224x224
- Cells were preprocessed (staining)

Kather, Jakob Nikolas, Halama, Niels, & Marx, Alexander. (2018). 100,000 histological images of human colorectal cancer and healthy tissue (v0.1) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.1214456

Normal



Cancer

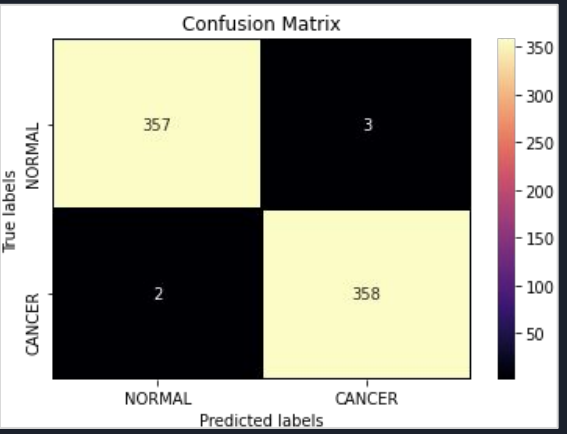


Pre-processing and Modeling

- To prevent our images from losing data, the image size remained the same at 224x224
- Before running the model, images were separated into a training, validation, and testing subdirectories.
- The dataset was undersampled to prevent a class imbalance.
    - 8000 images for each class for training
    - 400 images for each class for validating
    - 360 images for each class for testing
- Images were converted to JPEG from TIF
- Training: images were augmented by adding random rotations, random brightness, random zoom range, horizontal flip, and rescaling
- Validation: images were only rescaled
- Testing: images were only rescaled

Modeling

- Three models were iteratively created
    - All of them severely under fitted to the images
- Transfer learning was used as the final, fourth, model
    - ResNet50: was able to predict with 99.3% precision.
    - From 720 images not used in the training process, 5 were incorrectly classified.



Recommendation

What does the model tell us

- The predictions generated by the trained model took only a little over a couple of minutes to determine 720 images.

- Due to the high efficiency and high results. This model can become an extra tool in the medical field

Next Steps

- Research the market to see where this model would be of the most help

- Use other datasets to view how the model performs

- Consider using an “unstained” version of images to see if the model holds up to the same performance

Questions?

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