(Working) Project Title:
Detection of the Number of Stained Cells on Histology Slides Pertinent to Capsular Contracture on Histology Slides

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Capsular contracture is a pathology that could develop after implantation of a foreign capsule (e.g. a breast implant) into the body. Its exact causes are unknown and there is active research on understanding the disease better. There are some cells of interest thought to be contributive towards this pathology. In the process of doing further research on this issue, researchers around the world must manually count the number of stained cells on these slides – an arduous task, taking invaluable time away from highly skilled researchers.

Given the inherent diversity in the stained slides due to multitude of factors (e.g. amount of time in seconds stain left on the slide), as well as other factors such as where the pathology specimen was cut (hence out of a 3D volume of a cell, there may be only parts of the cell present in a slide without its nucleus) as well as others, this is an untrivial task, however, if it can be done with a certain amount of accuracy, a highly valuable one.

1. **Choice of Dataset**
   High quality images have been obtained from the plastic surgery wet lab at McGill. These are highly specific sets of images from pathology specimen that have been processed and stained in the lab.

2. **Methodology**
   a. **Data Preprocessing**
      All images are of the same dimension
      Low-quality images or highly unacceptable images (due to oversaturation in staining) have been pruned out.
   b. **Machine Learning Model**
      Usually CNNs are the typical method of choice for this type of models. U-nets have shown great success in these. However, ViT models will need to be also assessed to assess suitability and then a decision will be made.
   c. **Evaluation Metric**
      This is a classification problem, so confusion matrix and F1 score seem to be the reasonable metrics to go for.
      The sensitivity for this project will need to be at least 0.9 to be clinically useful.

3. **Application**
   I have already made a web interface for this project: https://pathometrics.com/
   The input will be a histology slide with similar specs as the training data (e.g. similar zoom level, similar pathology cut levels, etc. – these are pretty standard amongst all the wet labs specifically working on this)