Type: Master Thesis

Title: Adequacy for Transbronchial Needle Aspiration

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Summary

To develop an AI algorithm for the automatic detection of lymphocytes and tumor cells in transbronchial fine needle aspiration biopsies, to determine the *adequacy* ("lymphocytes or tumor cells present") or non-adequacy ("both not present") of the biopsy.

Problem: Rapid on-site evaluation (ROSE) during Endobronchial Ultrasound (EBUS) guided Transbronchial Needle Aspiration (TBNA) is associated with a decrease in the number of needle passes and a decrease of subsequent additional staging and diagnostic procedures. ROSE can be performed via live image streaming or robotic microscopes. While ROSE with live image streaming can be accomplished in a timely fashion due to the presence of experienced staff with Cytology expertise, ROSE using robotic microscopes can be time consuming due to limitations in remote navigation that hinder fast evaluation of a specimen that is usually cellular and bloody. We propose to evaluate the use of AI to identify potential areas of interest that will save screening time and also prevent potential misses.

The application of an AI for adequacy assessments demonstrates significant potential toward a leaner, more streamlined process for the adequacy experience without sacrificing quality. If successful, this study would serve as proof of principle that such a solution is feasible. If we can train an algorithm to identify regions of interest for the pathologist's review remotely, the potential application of this concept would allow for significantly decrease in time dedicated to ROSE through robotic microscopes and also makes a screening error less likely.

Goal: We propose a proof of principle study wherein we explore the feasibility of applying AI to the problem of adequacy assessment in robotic EBUS-TBNA procedures. Using whole slide images of Wright-Giemsa stained smears as input (see Figure 1), we aim to develop an algorithm that will identify Regions of Interest (ROIs) for evaluation. An ROI will be defined as containing cells which confirm sampling of a target lesion. In the context of EBUS-TBNA, presence of either lymphoid tissue or tumor cells would signify sampling of the target lesion. A board-certified cytopathologist will render an adequacy assessment of "Adequate" or "Not Adequate" based upon the AI generated ROIs. This result will be compared to the result given at the time of procedure. Other factors, including time to result and result as a function of smear quality, will also be assessed.

Data: 1000 consecutive Giemsa stained FNA smears from mediastinal staging procedures. We will add additional cases if necessary to adequately cover slide to slide variance. 50 consecutive smears separate from the training data will be used to test the algorithm.

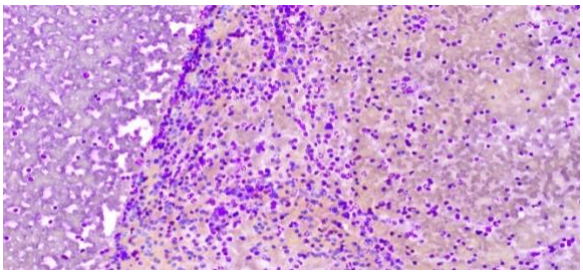

Figure 1: Example image of a FNA smear image.

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