A Deep Learning-based Framework for Registration of Faxitron and Histopathology Images of the Breast

Negar Golestani

October 2022
Introduction

• **One woman in eight** with invasive breast cancer over her lifetime
  - In 2022, estimated 287,850 new cases and 43,250 deaths among women in the US*

• **Neoadjuvant chemotherapy** for treatment before surgical excision
  - helps reduce recurrence risk, extent of surgery, and post-operative complications

• After surgery, **study excised tissue to assess treatment**
  - Presence and extent of residual invasive cancer is a strong **prognostic factor** for risk recurrence
Pathology Workflow

1. **Screening Mammography**
2. **Diagnostic MRI, biopsy, etc.**
3. **Abnormal Cancer or High-risk Lesion**
4. **Treatment Chemotherapy and Surgery**

**Stanford Pathology Workflow**
- **Excised Tissue**
- **Slicing**
- **Pathology**
- **Selection**
- **Histology Analysis**

**Photos:** https://www.vectorstock.com, https://www.dreamstime.com
Motivations

- **Automatic identification** of **invasive** and **in situ** carcinoma on **faxitron** radiographs of excised tissue using AI methods
  - Improve process of specimen evaluation
  - Select regions with high likelihood of invasive cancer for histologic evaluation more accurately and efficiently
Data

- Data of 100 women, including Faxitron radiographs and Histopathology slides
**Detection**  
Develop AI models to detect the extent DCIS and IBC on Faxitron radiographs.

**Registration**  
Create accurate spatial ground truth labels of DCIS and IBC on Faxitron radiographs.

**Data Preprocessing**  
Prepare faxitron and histopathology images.

---

**Framework**
Data Preprocessing
Registration

Data Preprocessing
- Histopathology Images
- Faxtron Images

Registration
- Aligned Images
- Histopathology Mapped onto Faxtron

Detection
- Test Data
- AI Model
- Predictions

Preprocessing
- Metric
- Interpolator

Registration
- Optimizer
- Transform
- Transform Parameters

Fixed Image

Moving Image
Thank You!

Dr. Mirabela Rusu  
Assistant Professor of Radiology

Dr. Bruce Daniel  
Professor of Radiology

Dr. Gregory Bean  
Assistant Professor of Pathology

Aihui Wang  
Life Science Research Professional I, Pathology