

# Classification of Ovarian Neoplasms

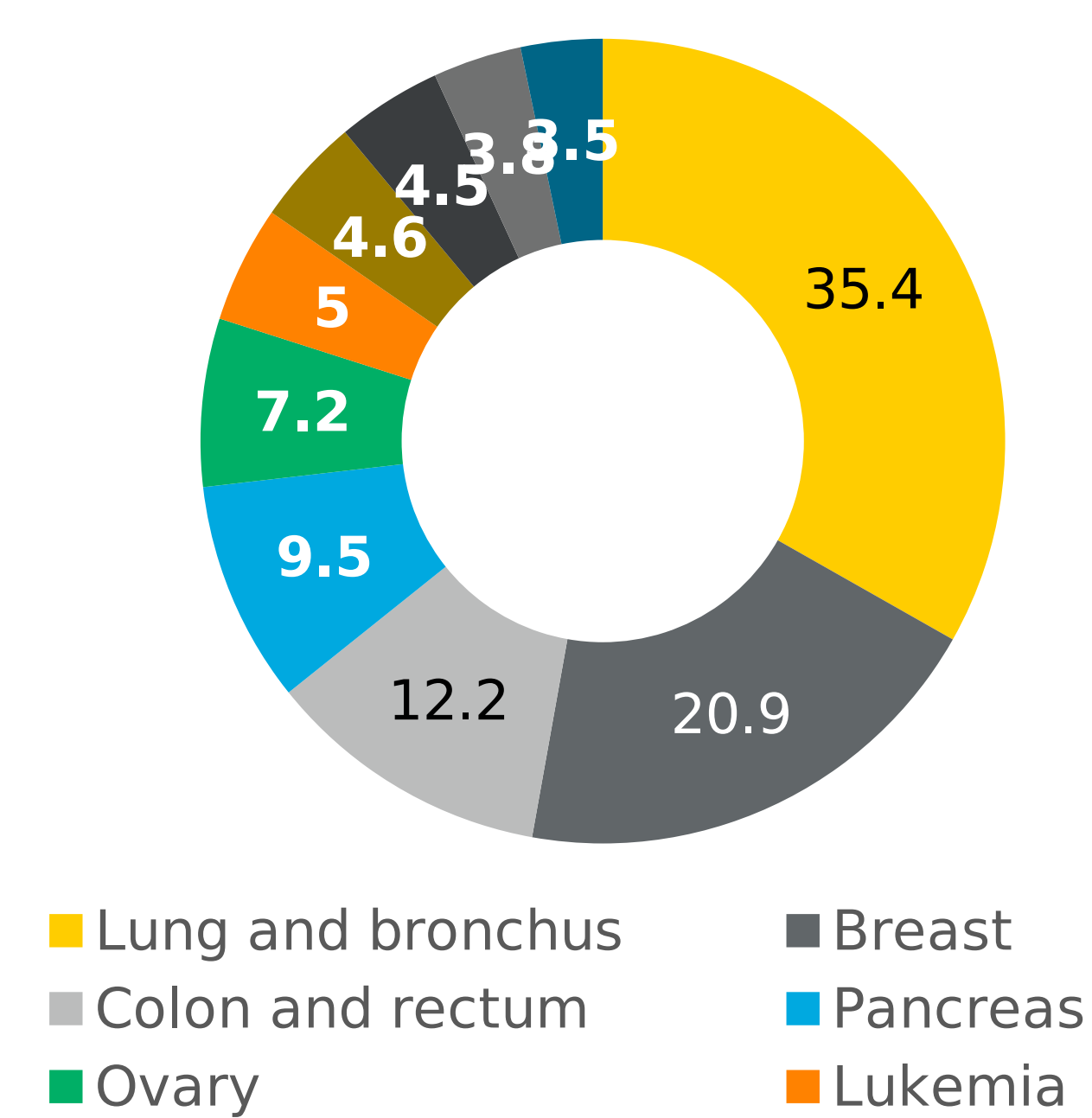
## 3D Supervised Contrastive-Learning Approach

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### Background

Ovarian cancer **ranks 5<sup>th</sup> in cancer deaths** among women, accounting for more deaths than any other cancer of the female reproductive system. [1]

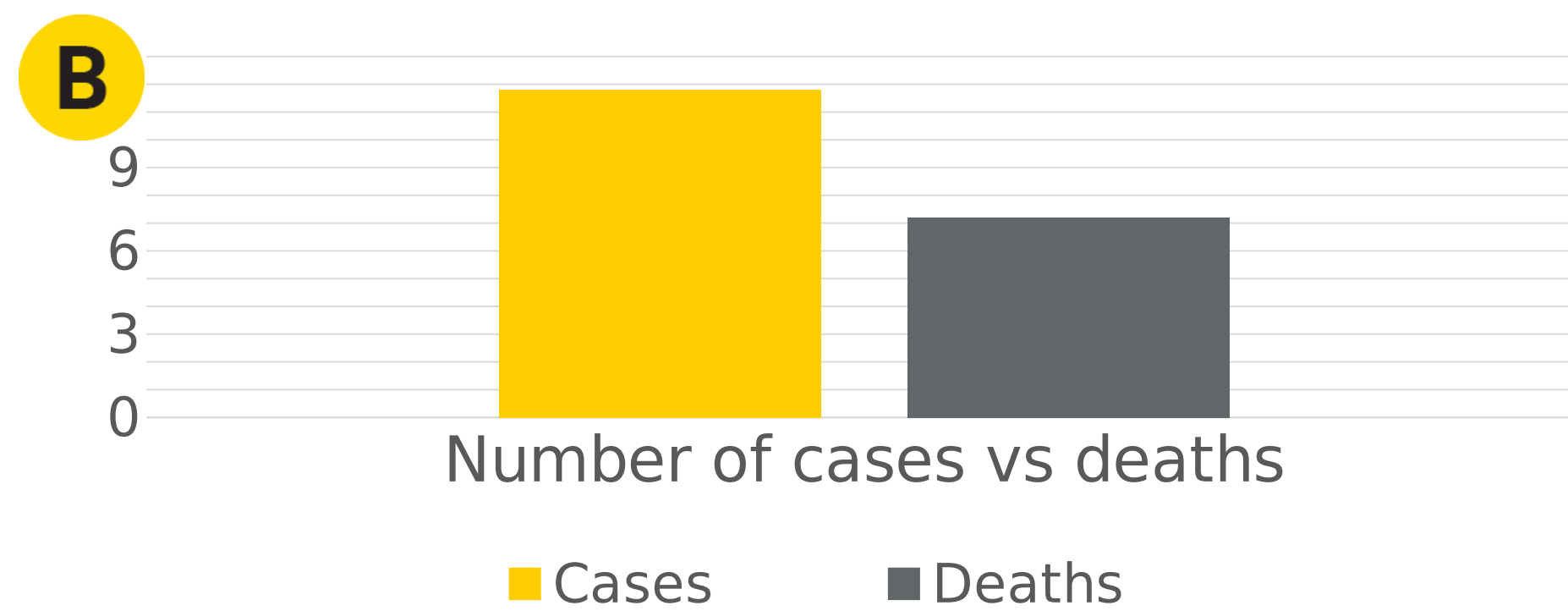
#### A 10 Deadliest cancer in Women



#### Why ovarian cancer is so deadly?

- Ovarian cancer, like breast cancer, can be easily treated if caught early.
- However, there are few good ways of catching it early, unlike breast cancer and mammograms, which is why it **has a higher death rate than breast cancer.**
- Deaths per year per 100,000 women: 7.2
- Average Annual Change (2010-2014): -2.3%

#### Ovarian Cancer Stats



#### Challenges:

- Large number of ovarian cyst
- Manual inspection is too much time consuming and costly
- Non-invasive diagnosis methods are not well developed

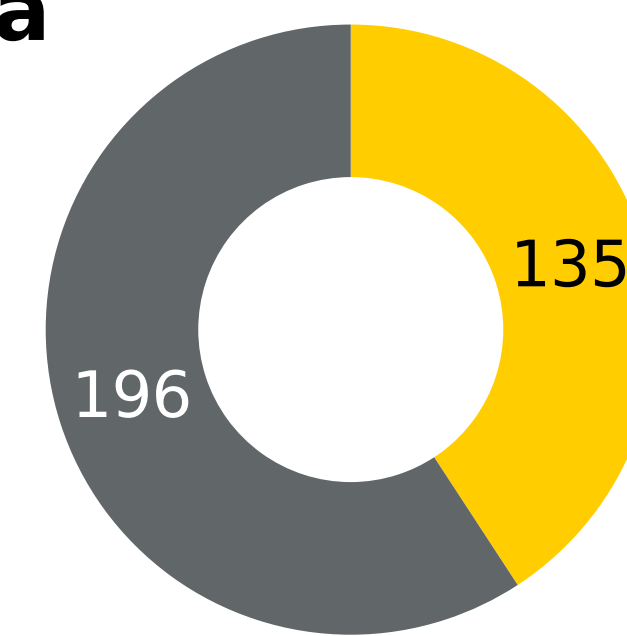
### Dataset and Experimental Setup

All the CT data collected at the university of Iowa hospital and clinics.

A. CT volumes are cropped and resized to 128x128x64 shape for model training.

B. ROI selected at the lower abdomen of the patient

#### C UIHC Ovarian Cancer Data



#### D Stratified Five Fold CV

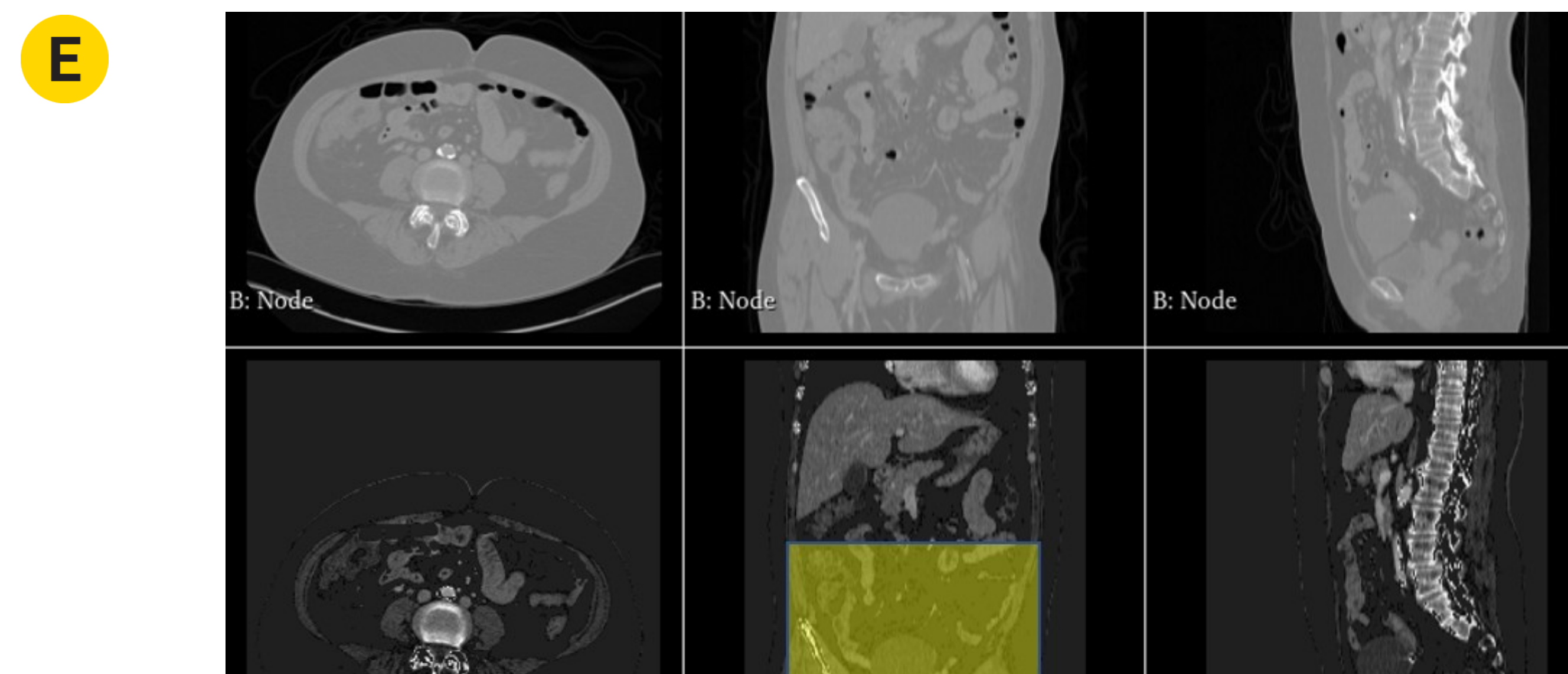
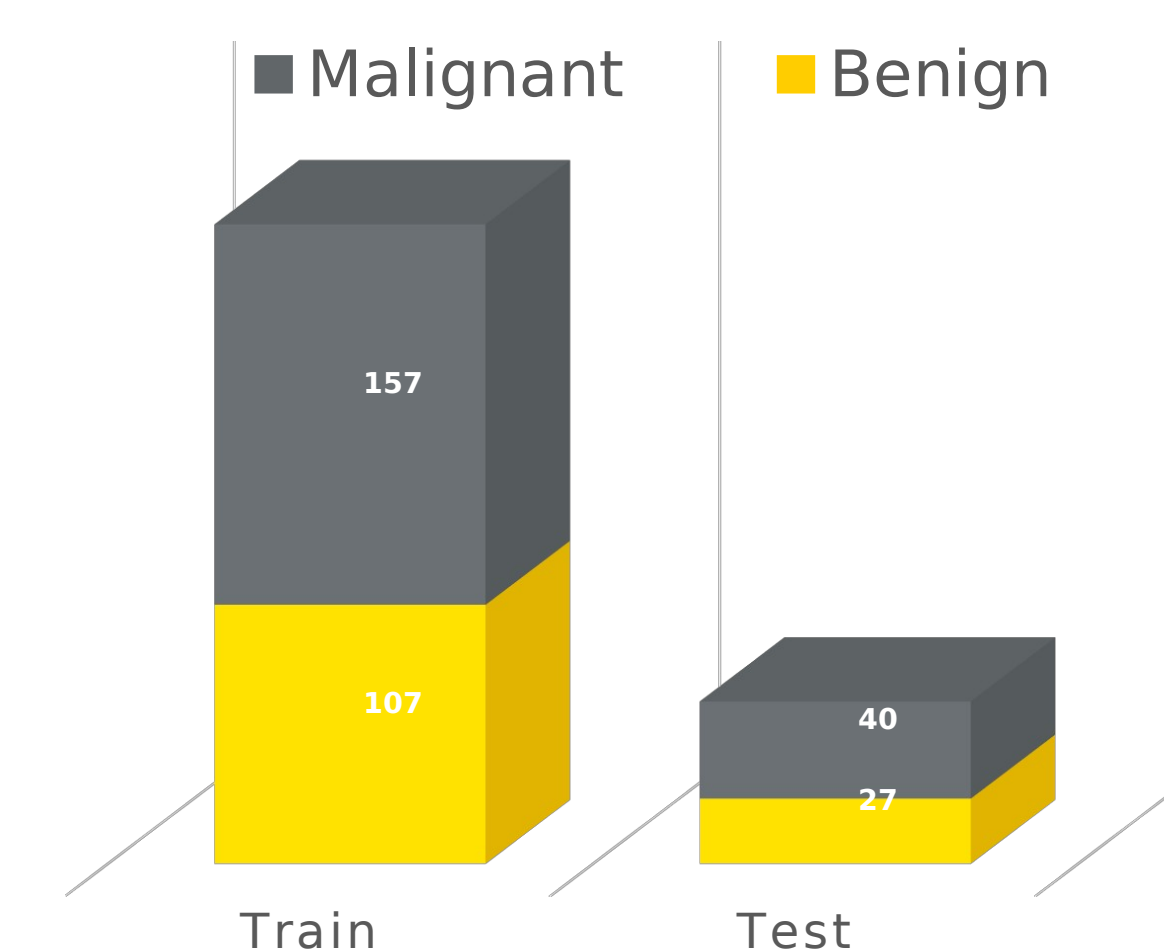
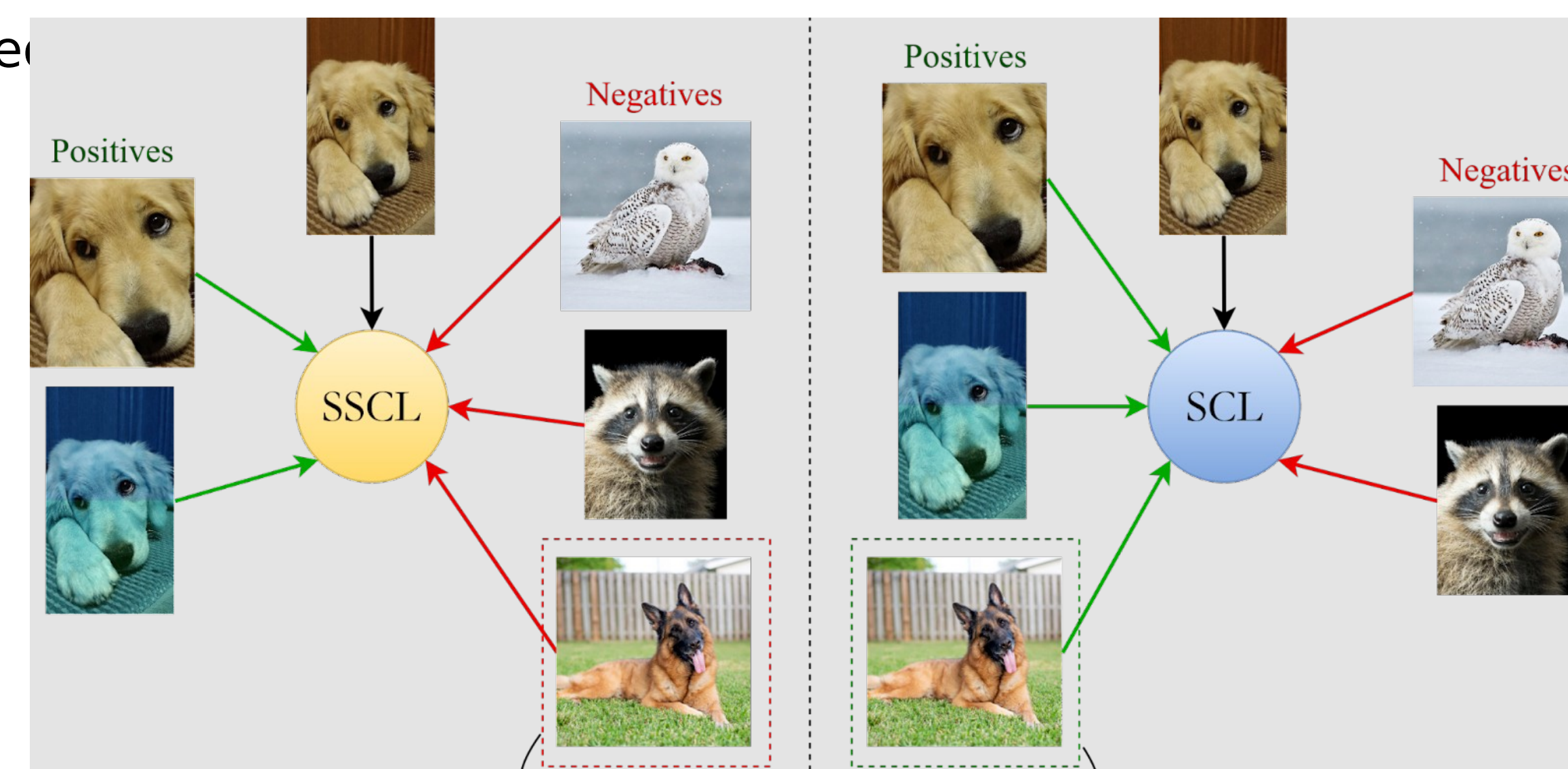


Fig: input data preprocessing, thresholding, ROI detection, data augmentation

### Method

3D Encoder of the network was pretrained with contrastive losses

MLP head was attached on top of the pretrained encoder with weights frozen and trained



### Results

**Table : Performance comparison of models on CT volume**

#### Panel A: Baseline 3D models

Model	Accuracy	AUC	Recall	Specificity
VGG19	84.3	84.1	90.55	82.96
ResNet18	80.1	77.9	88.3	67.5
ResNet50	81.6	80.1	88.99	71.18
DenseNet121	82.15	80.58	80.42	80.73

#### Panel B: SCL 3D models

Model	Accuracy	AUC	Recall	Specificity
VGG19	89.48	88.58	93.45	83.7
ResNet18	89.17	88.2	93.42	82.96
ResNet50	<b>92.8</b>	<b>92.4</b>	94.45	<b>90.37</b>
DenseNet121	91.16	90.61	<b>94.88</b>	86.35

### Conclusions & Future Directions

This work leverages Supervised Contrastive learning approach to automate the diagnosis of ovarian tumors.

Collecting labeled medical data is costly. In future research, semi-supervised contrastive learning will enable less amount of annotated data to improve the model performance.

### Acknowledgments

We are thanking University of Iowa Hospital and Clinics to make the dataset available for research

### References

- American Cancer Society
- Khosla, Prannay, et al. "Supervised contrastive learning." Advances in neural information processing systems 33 (2020): 18661-18673.