

# **SKIN CANCER ANALYSIS: DNN**

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## Background

**5.4 MM**

Cases of skin cancer diagnosed per year

**20%**

Of Americans will develop skin cancer by  
70

**99%**

survival rate with early detection

## Lit Review

**84%**

sensitivity and specificity by  
dermatologists for BCC

**15%**

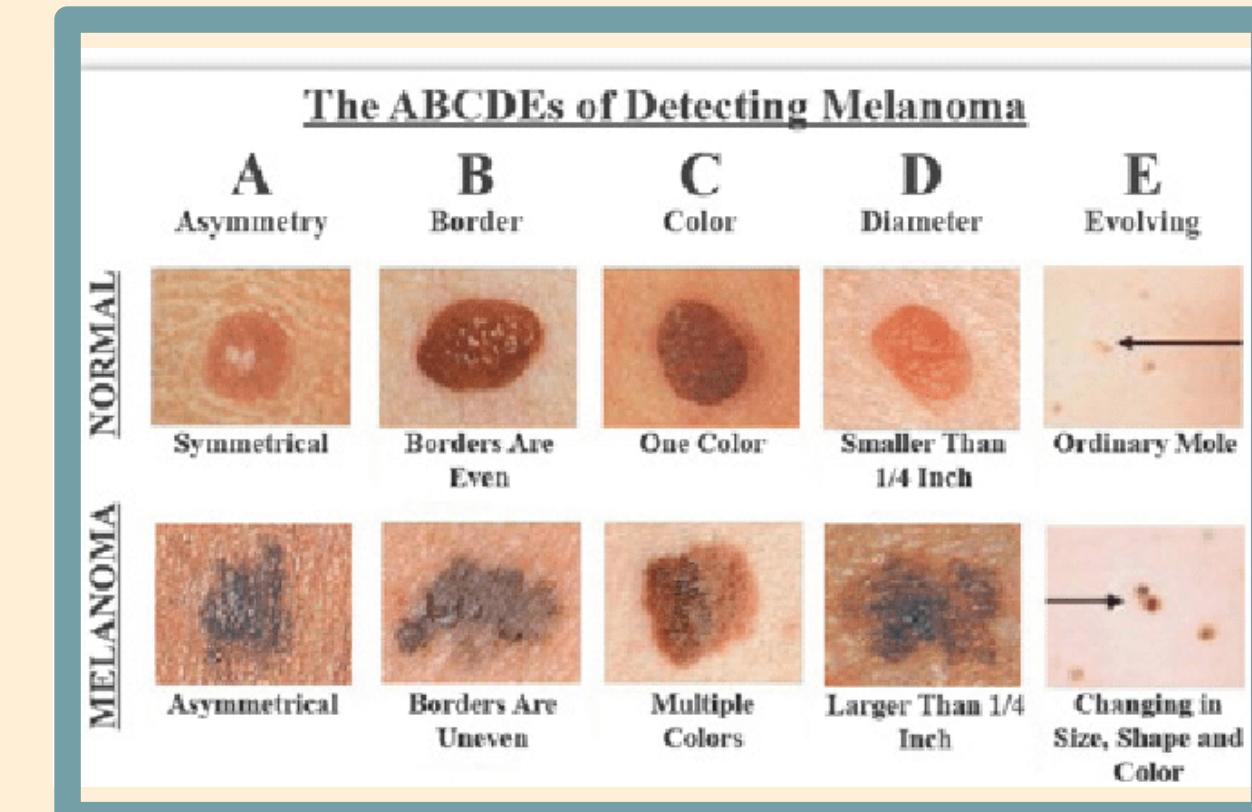
increase in accuracy when doctors use AI

**10%**

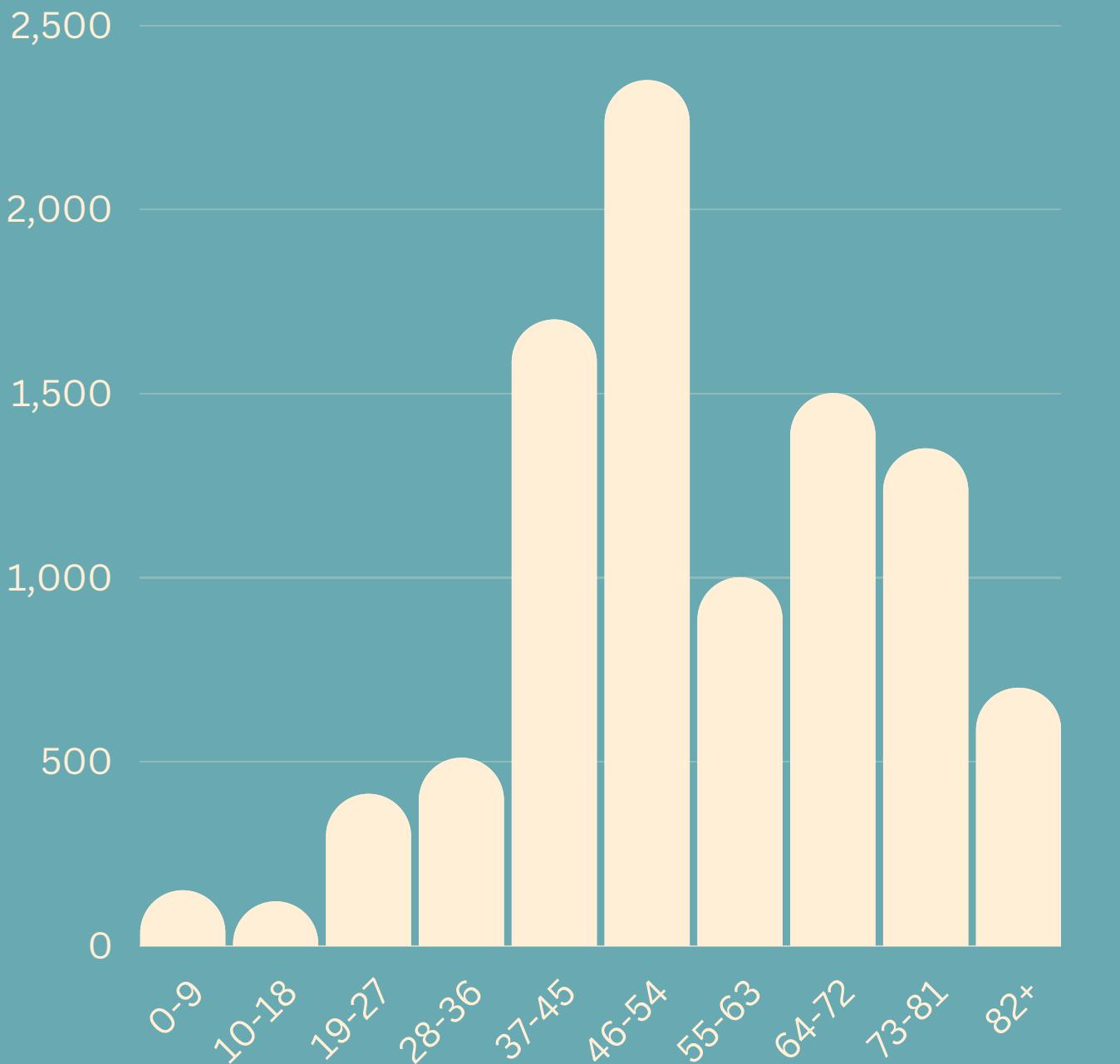
average image failure according to the  
2018 classification study

# Description

- 10000 training Jpegs
  - 300kb each
- 1500 test
- Metadata: Age, Locus, Sex, Histology
- Competition - to compare our accuracies and efficacy



## Distribution of Images by Age



Follow up  
36%

Consensus  
9.6%

Confocal  
1%

Histology  
53.4%

## Diagnosis Denotation

## Packages

PyTorch with a conda environment

## Network

We used res net with some unfrozen layers, and later an ensemble

## Preprocessing

Need to homogenize the location of the object in the center of frame.

## Metadata

Added this encoded data as a layer after running the images through the first few layers

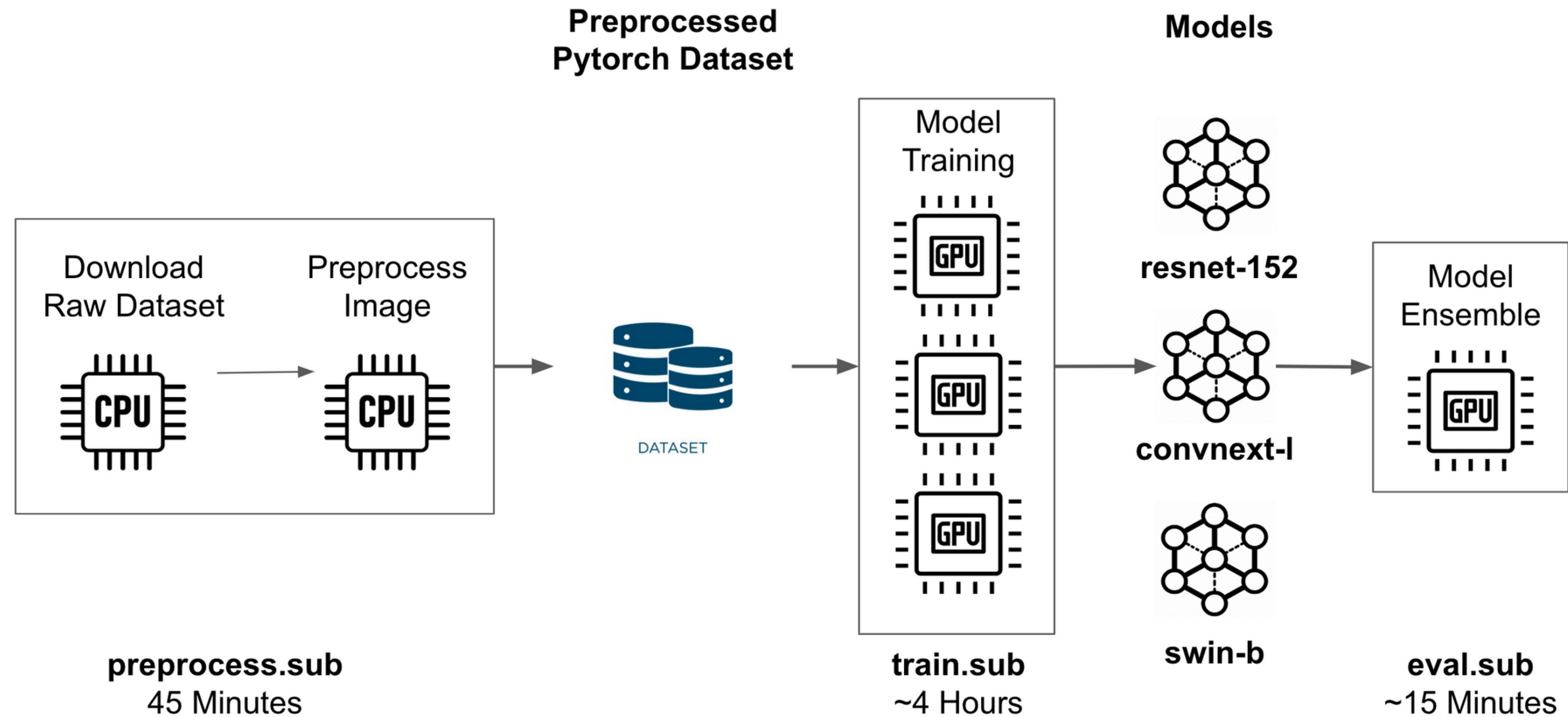
## Encoding

Used one hot encoding for metadata to be added to a later layer

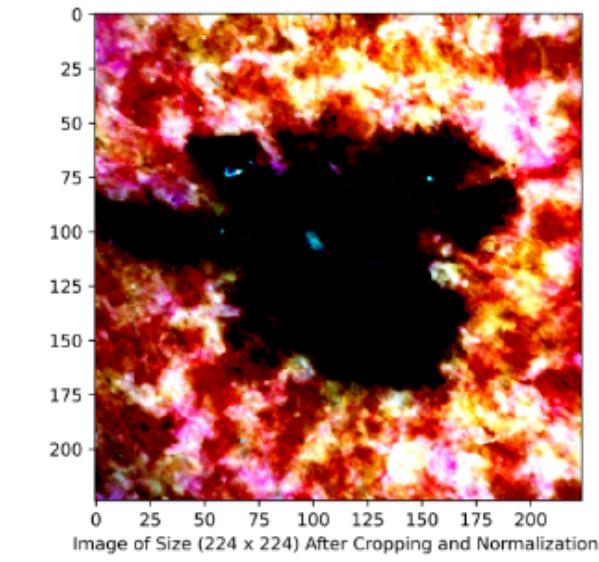
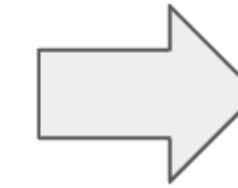
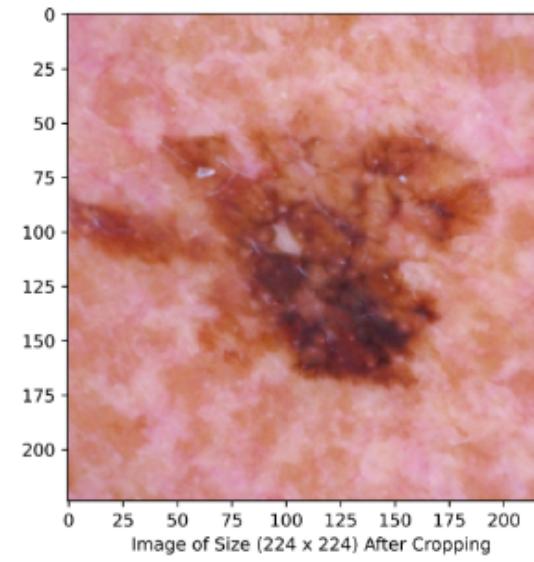
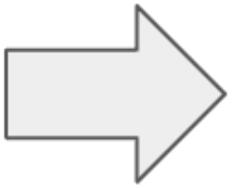
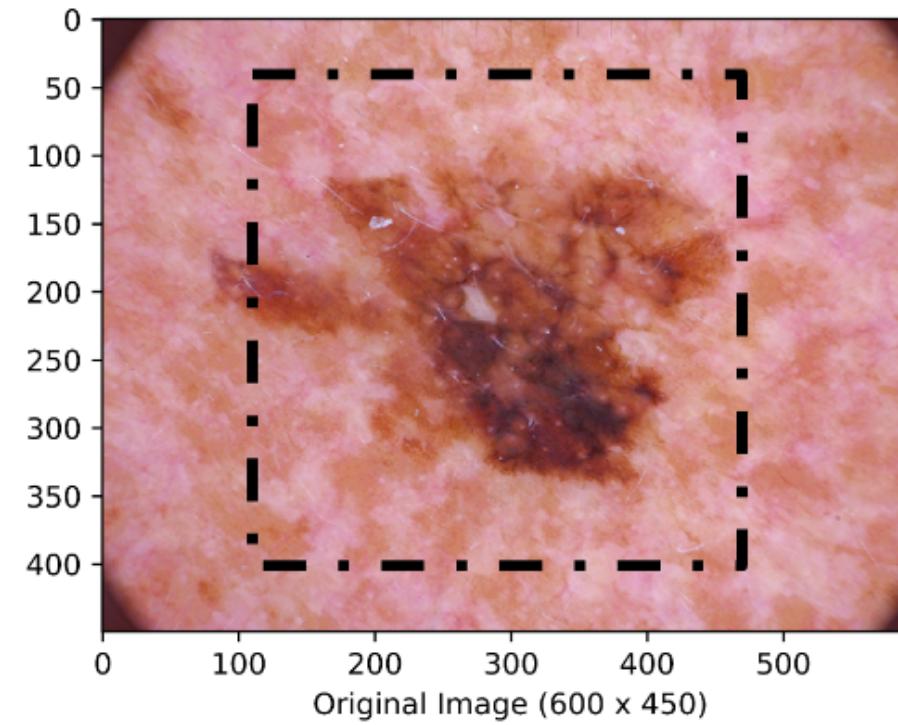
## Results

Differs from other methodologies. Parallel training for ensemble.

# Computation Pipeline on CHTC



# Preprocess

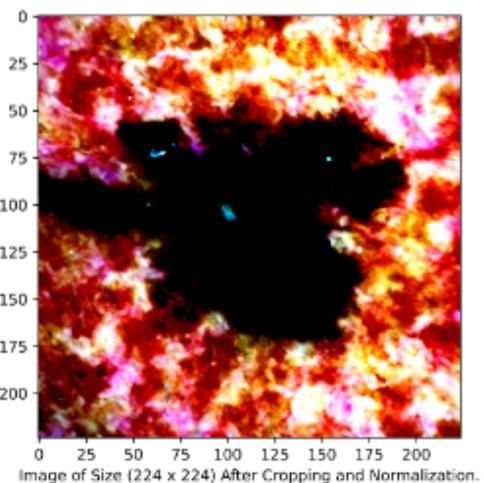


Original Image  
(600 x 450)

Resized and Cropped Image  
(224 x 224)

Normalized Image  
(224 x 224)

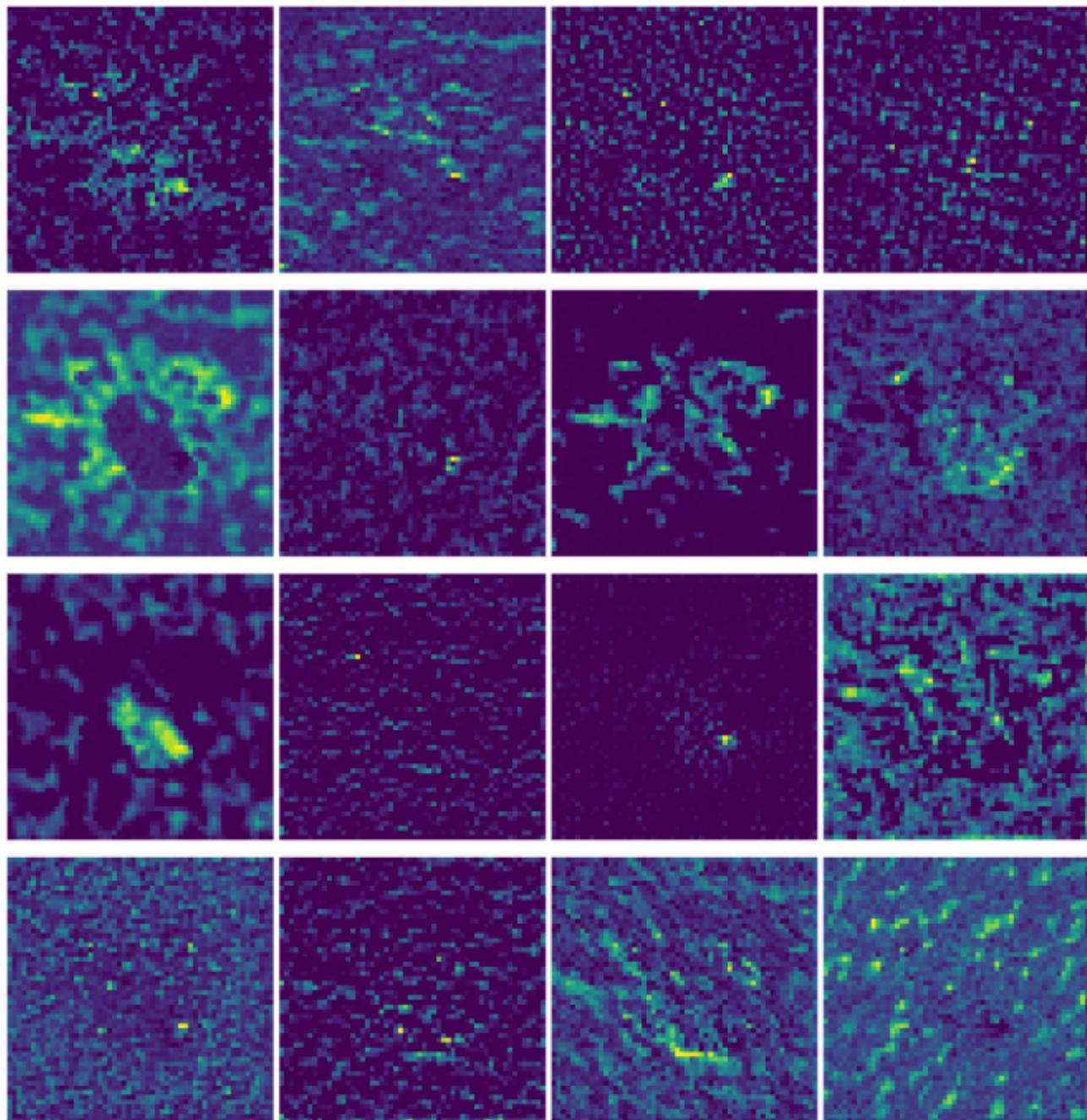
# Feature Extraction



Deep  
Neural  
Network



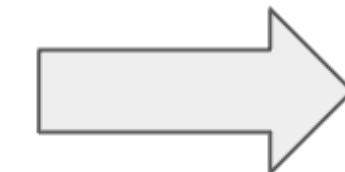
Input Image  
(224 x 224)



Extracted Features  
(28 x 28)

[  
0.14,  
0.33,  
0.12,  
. . .  
0.08,  
0.19  
]

Deep  
Neural  
Network



Features Vector  
1 x 2048

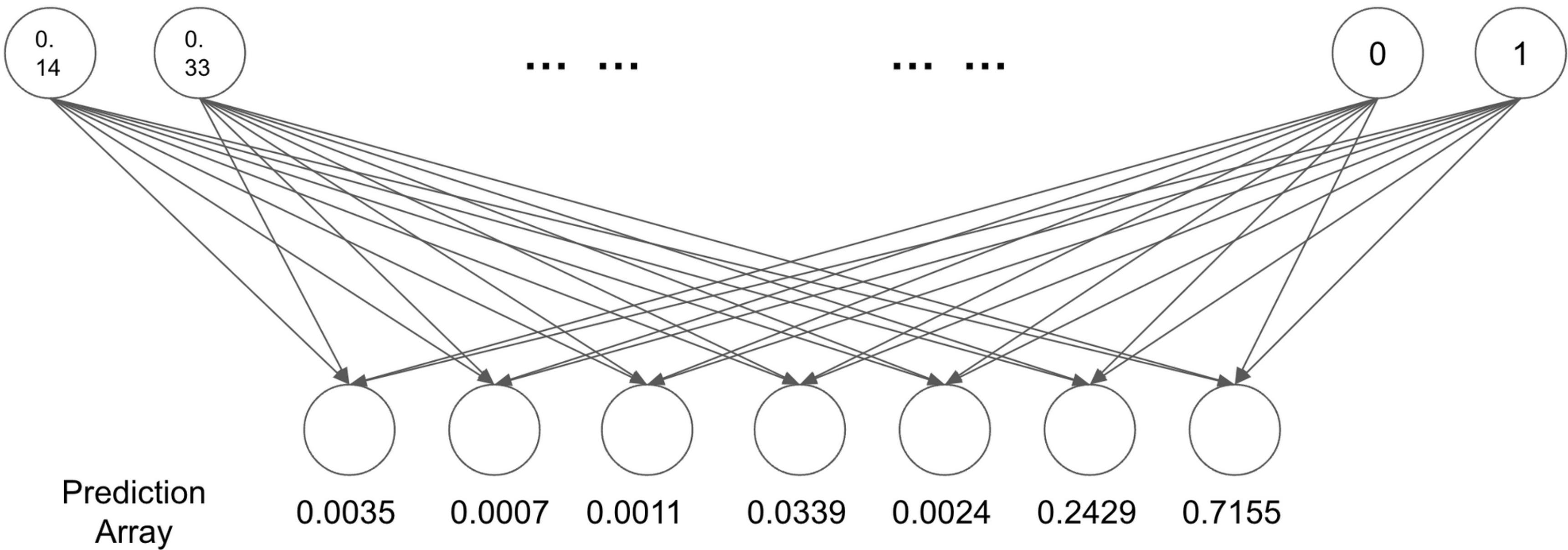
## Prediction

[ 0.14, 0.33, ... , 0.08, 0.19]

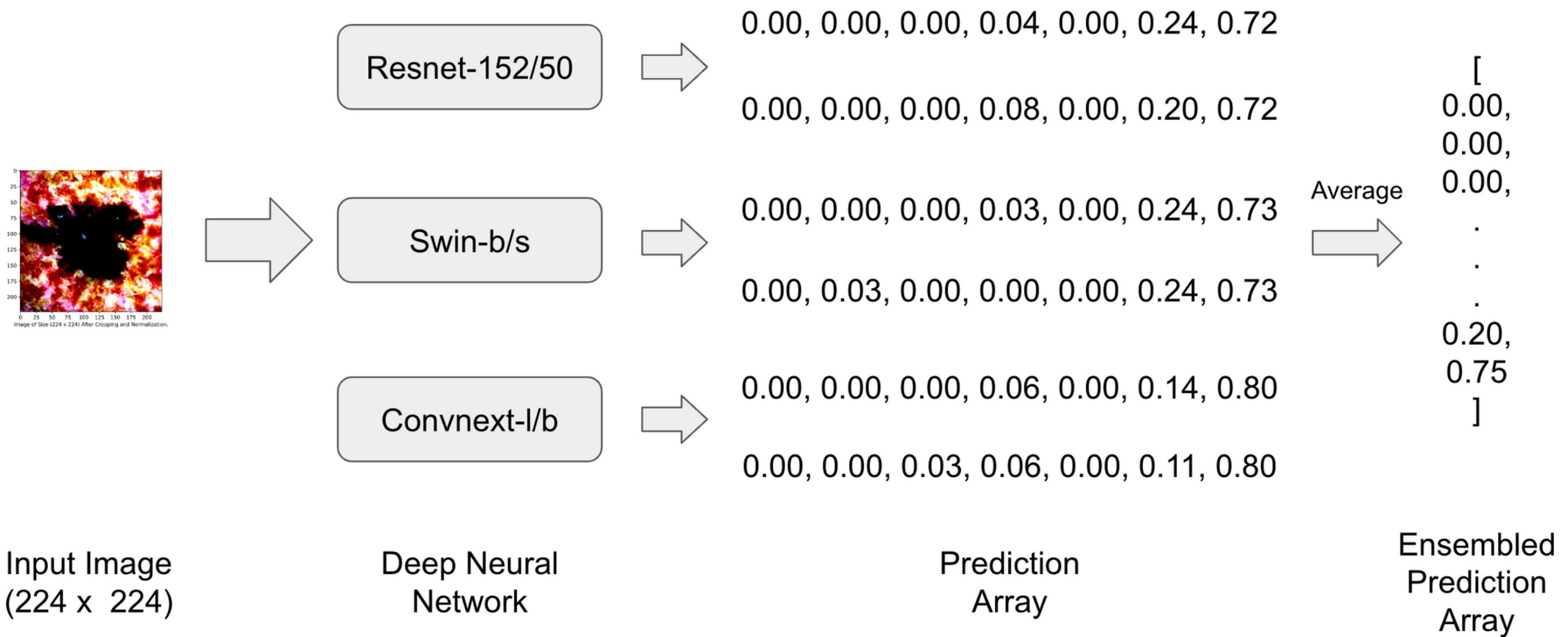
## Feature Vector

[0, 1, ..., 0, 1]

## Metadata Encoding

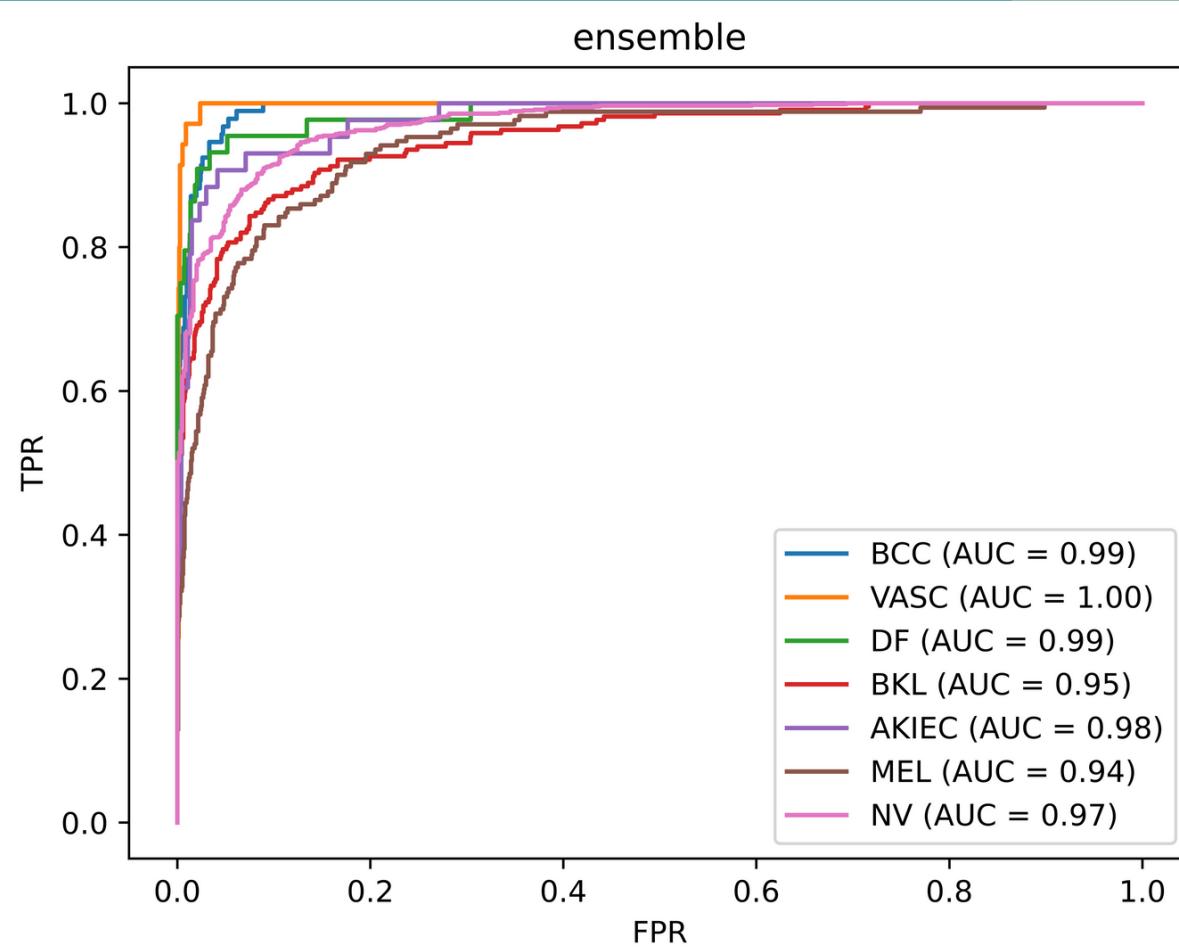


# Ensemble Prediction



# RESULTS

## The resnet/swin/convnext ensemble



Overall accuracy  
of 84%  
BAC = 81.4

We ran separate  
jobs for parallel  
preprocessing  
and for the  
networks (3 gpu)

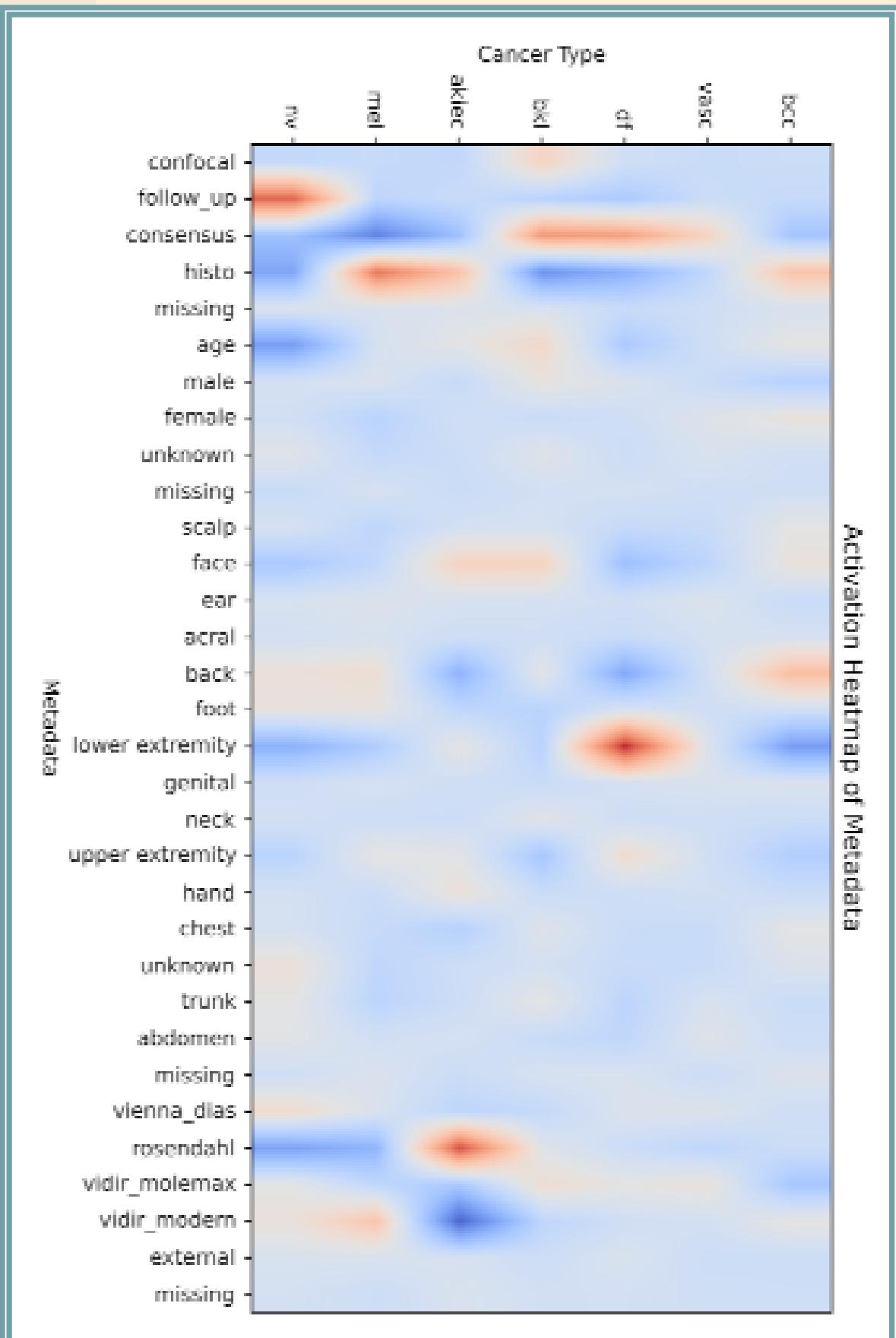
Memory utilized:  
15GB  
Disk space  
required: 40GB  
NVIDIA A100-  
SXM4-80GB

	BCC	VASC	DF	BKL	AKIEC	MEL	NV
BCC	82	0	1	2	5	2	1
VASC	3	31	0	0	0	0	1
DF	4	0	35	2	1	0	2
BKL	6	0	3	166	10	20	12
AKIEC	3	0	1	4	32	3	0
MEL	3	2	1	10	3	129	23
NV	9	2	7	34	3	60	793

- Best = VASC @ 88.6
- Worst = AKIEC @ 74.4

	BCC	VASC	DF	BKL	AKIEC	MEL	NV	Mean Value
Accuracy	0.974	0.995	0.985	0.932	0.978	0.916	0.898	0.954
Specificity	0.98	0.997	0.991	0.96	0.985	0.937	0.935	0.969
Sensitivity	0.882	0.886	0.795	0.765	0.744	0.754	0.873	0.814
AUC	0.992	0.998	0.986	0.95	0.978	0.943	0.972	0.974

- Best AUC = .998 (VASC)
- Worst = .943 (MEL)



- The most common physical indicator is a lump or localized swelling. Our data is trained on 2d images, which might limit efficacy.
- May have issues with lighting variability and lack of standardization
- Ways to improve:
  - Lighting
  - Dimensionality
  - More runs with different layers



## CONSIDERATIONS

# SOURCES

[\*\*https://pubmed.ncbi.nlm.nih.gov/9602875/\*\*](https://pubmed.ncbi.nlm.nih.gov/9602875/)

[\*\*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC149  
5212/\*\*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1495212/)

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9804919303491\*\*](https://www.sciencedirect.com/science/article/pii/S0959804919303491)

[\*\*https://www.ncbi.nlm.nih.gov/books/NBK68729/\*\*](https://www.ncbi.nlm.nih.gov/books/NBK68729/)

[\*\*https://challenge.isic-archive.com/landing/2018/\*\*](https://challenge.isic-archive.com/landing/2018/)

[\*\*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC451  
3405/\*\*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4513405/)

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