

# Identifying Cervix Types Using Deep Convolutional Networks



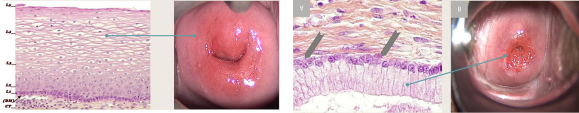
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- Inception v3 performs best, followed by Resnet; type 2 and 3 can be better identified than type 1
- Transfer learning performs poorly on our dataset, due to the significant differences from ImageNet
- The automated system can improve the ability to make real-time determinations on the cervix type and the follow-up treatment in resource limited settings

## Objective

- Identify three types of cervix



Ecto-cervix cell      Endo-cervix cell

- Distribution of ecto/endo-cervix cells determines cervix types

- Minimize cross-entropy loss function

$$L = -\frac{1}{N} \sum_{i=1}^N \sum_{j=1}^M y_{ij} \log(p_{ij})$$

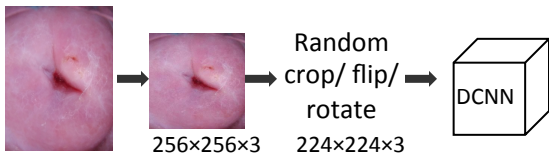
## Dataset and Preprocess Scheme

- Distribution of class labels

Cervix Type	Type 1	Type 2	Type 3	Total
Main	249	781	450	1480
Additional	1187	639	1972	3798

- Only use the main dataset

- Preprocess scheme



2448x3264x3,  
3096x4128x3,  
...

## Models

- Summary of four models

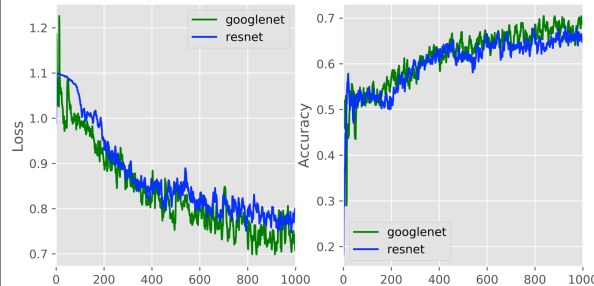
...	AlexNet	Inception v3	VGG16	ResNet
Layers	8	22	16	34
Trainable Parameters	12.6M	6.17M	12.6M	21.9M
Training Time Per Epoch	~17 s	~42 s	> 1 min	~33 s

- Hyper-parameters specified

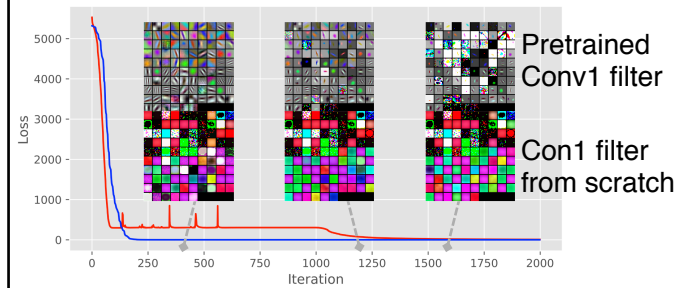
...	AlexNet	Inception v3	VGG16	ResNet
L2 reg.	0.001	0.001	0.001	0.0001
lr	0.001	0.001	0.0001	0.001
Dropout	0.8	0.4	0.8	0.8
Update rule	Mom.	Mom.	RMSprop	RMSprop
Mini-batch size	64	64	64	64

## Experimental Results

...	AlexNet	Inception v3	VGG16	ResNet
Training Acc.	65%	70%	71%	69%
Training Loss	0.79	0.67	0.68	0.79
Validation Acc.	60%	70%	63%	64%
Validation Loss	0.89	0.64	0.91	0.83
Test Loss	0.92	0.80	1.72	0.82

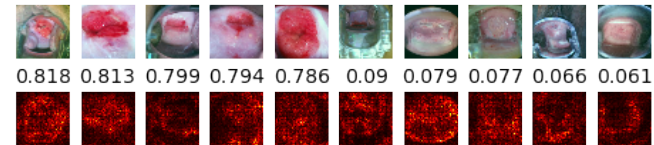


## AlexNet: Pretrained vs from Scratch

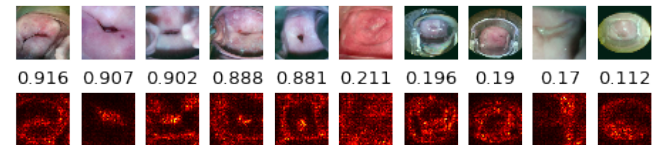


## GoogLeNet Results Visualization

Type 1 Pred. Dist.: [0.57, 0.40, 0.03]



Type 2 Pred. Dist.: [0.15, 0.80, 0.05]



Type 3 Pred. Dist.: [0.01, 0.39, 0.60]

