Snow Leopard Conservation with Deep Learning

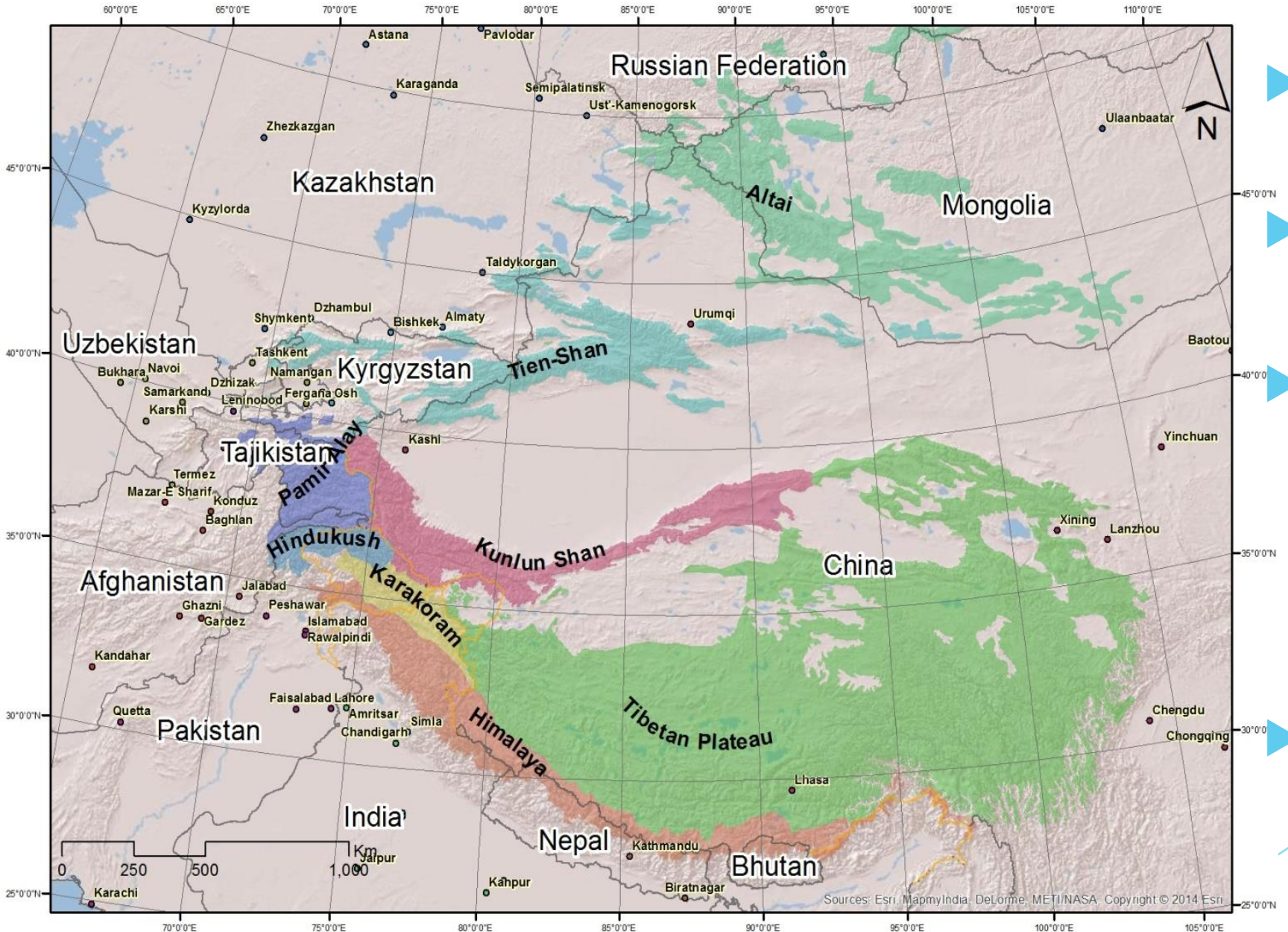
Mark Hamilton + Rhetick Sengupta
marhamil@microsoft.com
rheticks@microsoft.com

Snow Leopard Trust

MMLSpark
aka.ms/mmlspark


Snow
Leopard
Trust

Habitat



- 3,900-6,500 individuals left in the wild
- Range spread over 1.5 million km^2
- Little known about their ecology, behavior, movement patterns, survival rates
- More data required to influence survival

Threats

Mining

Poaching

Retribution Killing

Community Based Conservation

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Snow leopard no longer 'endangered'

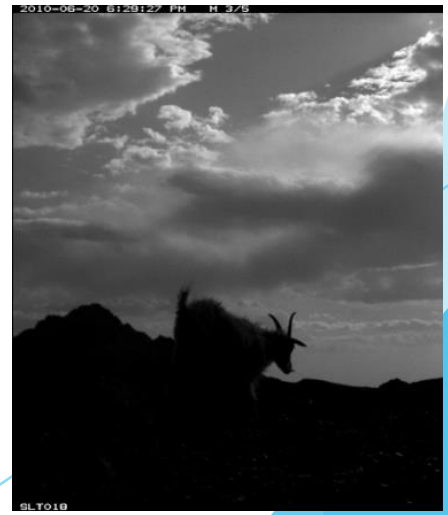
14 September 2017 Share

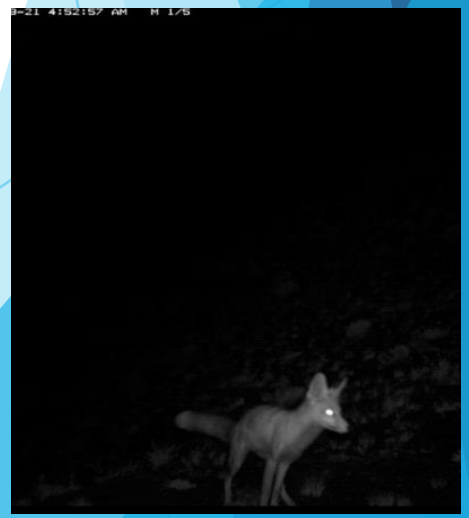
Statement on IUCN Red List Status Change of the Snow Leopard

The Snow Leopard Trust, one the leading conservation organizations working to protect this cat, opposes the IUCN's decision to change the snow leopard's Red List status from 'Endangered' to 'Vulnerable'.

Camera Trap Images

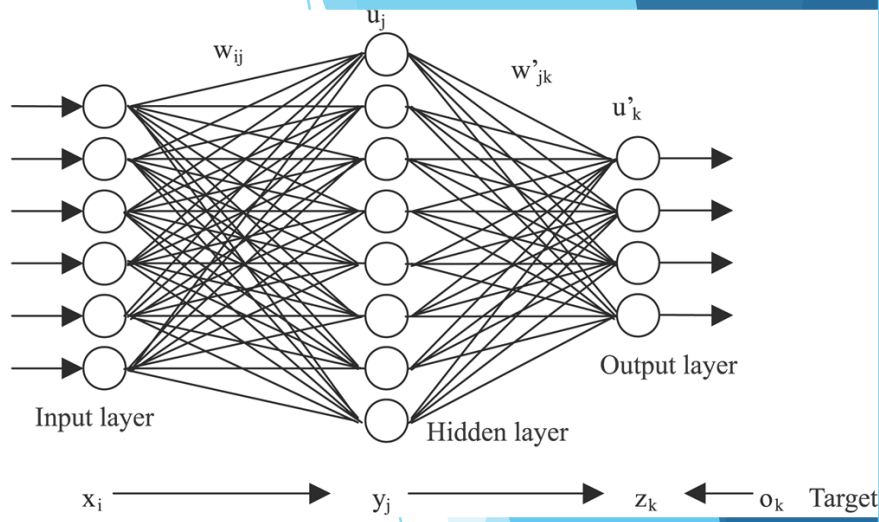
Manually classifying 20k images took 300 hours → 1.3 million will take 19,500 hours

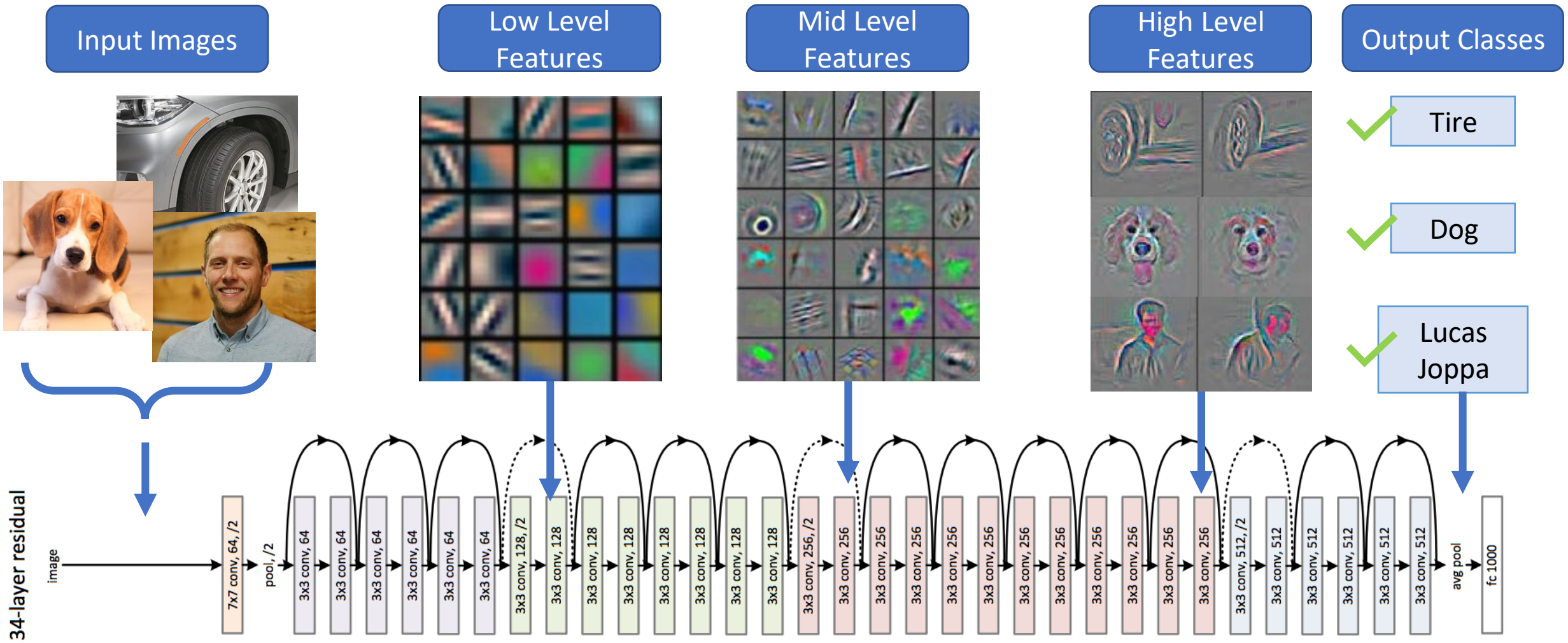




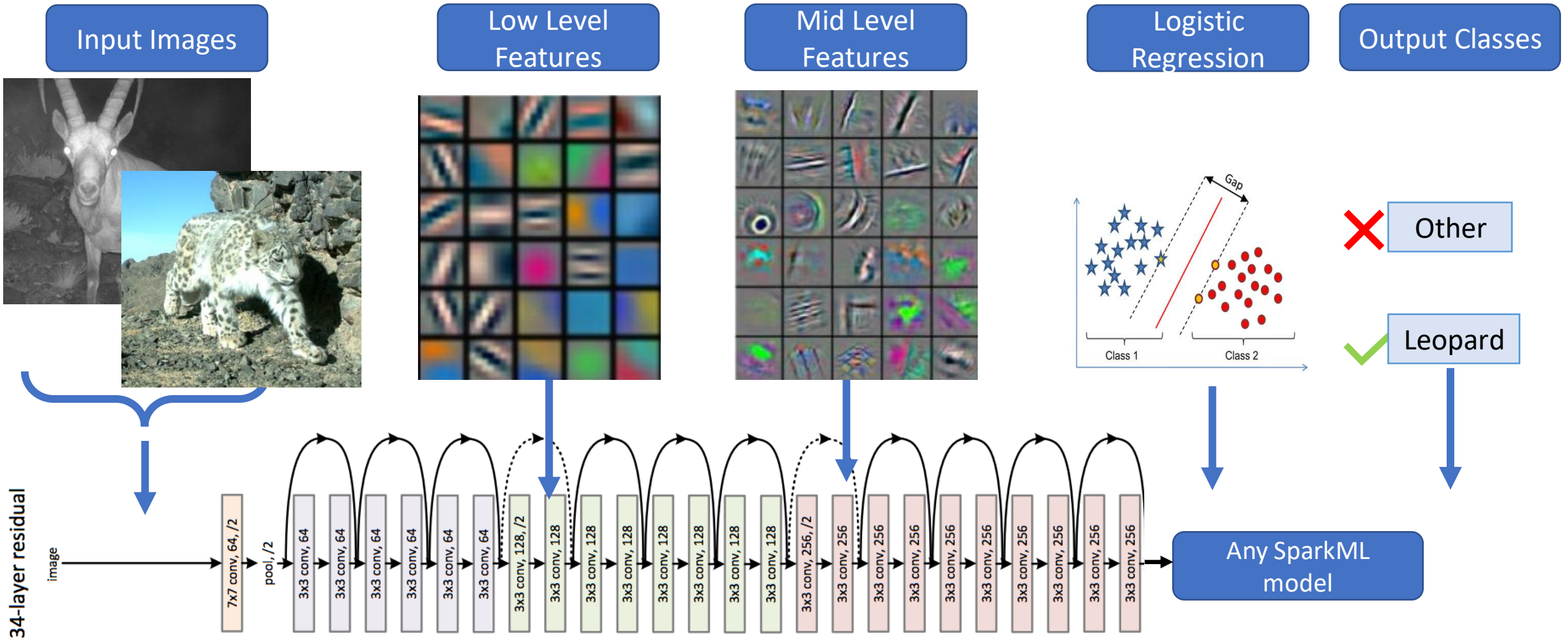
Deep Learning

- Brain-like algorithms trained with gradient descent
- Has become a recent favorite because:
  - Spectacular performance in many domains
  - Quick training
  - Low memory
  - Large space of possible model architectures
  - Automatic differentiation software makes it very easy





Filters from Zeiler + Fergus 2013

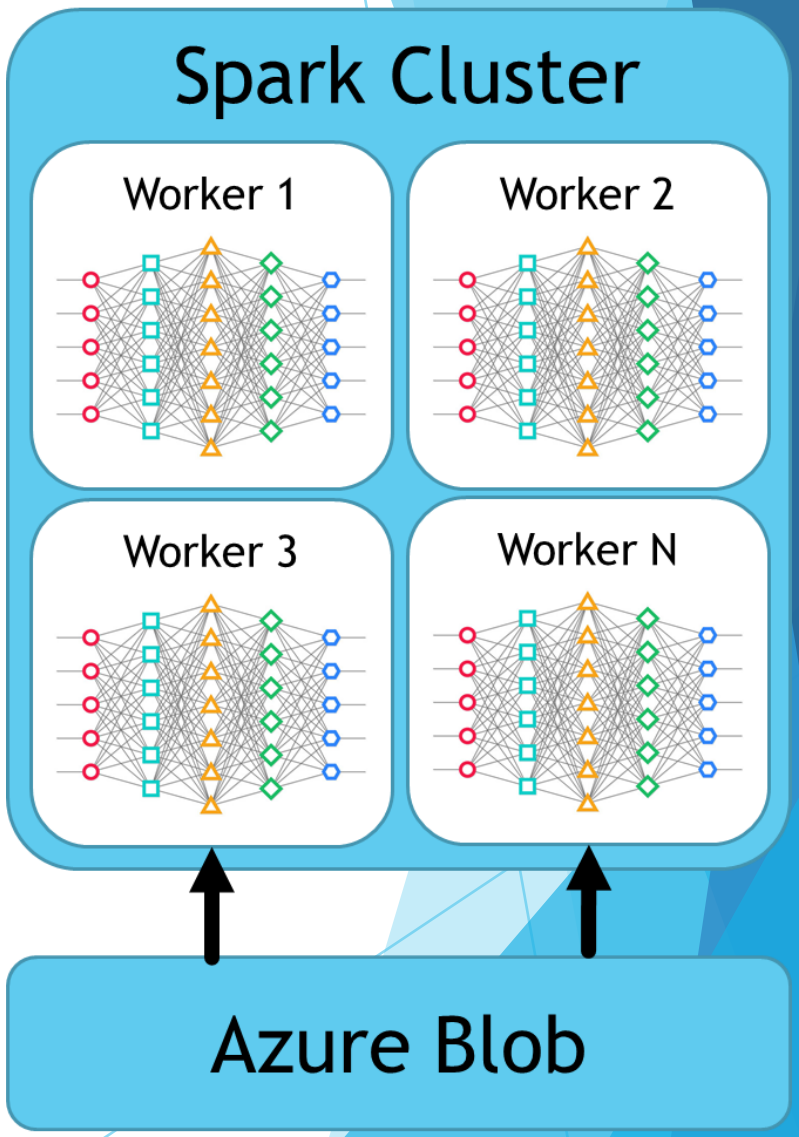


Filters from Zeiler + Fergus 2013

MMLSpark

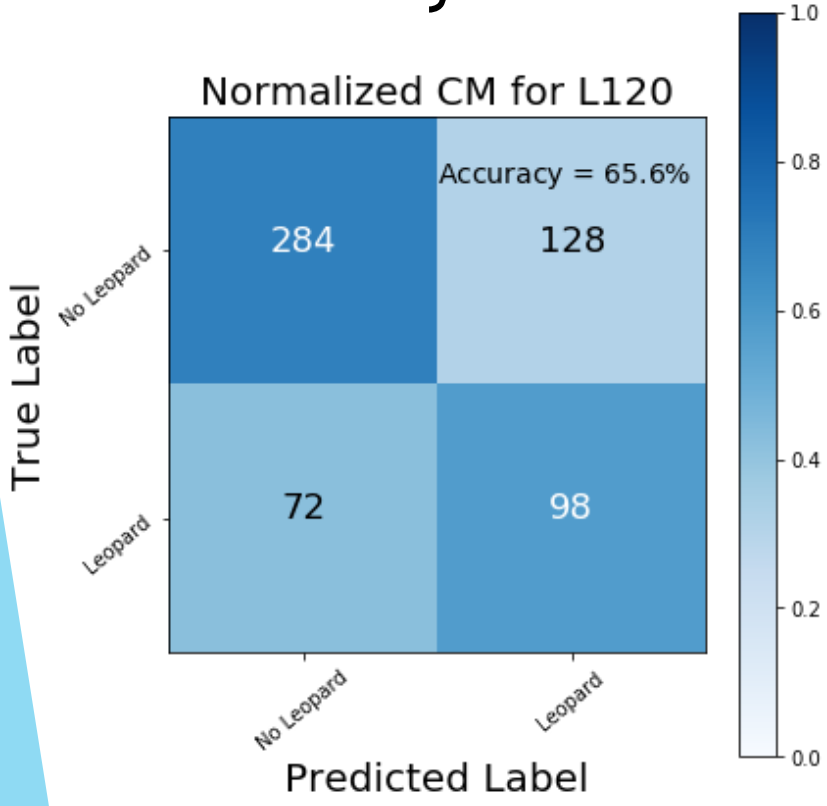
aka.ms/mmlspark

- Open Source
  - Contributions welcome!
- **Combines the Distributed Computing Framework Spark, with the Deep Learning Framework CNTK.**
- Lets you create distributed and fault-tolerant applications in a few lines of code

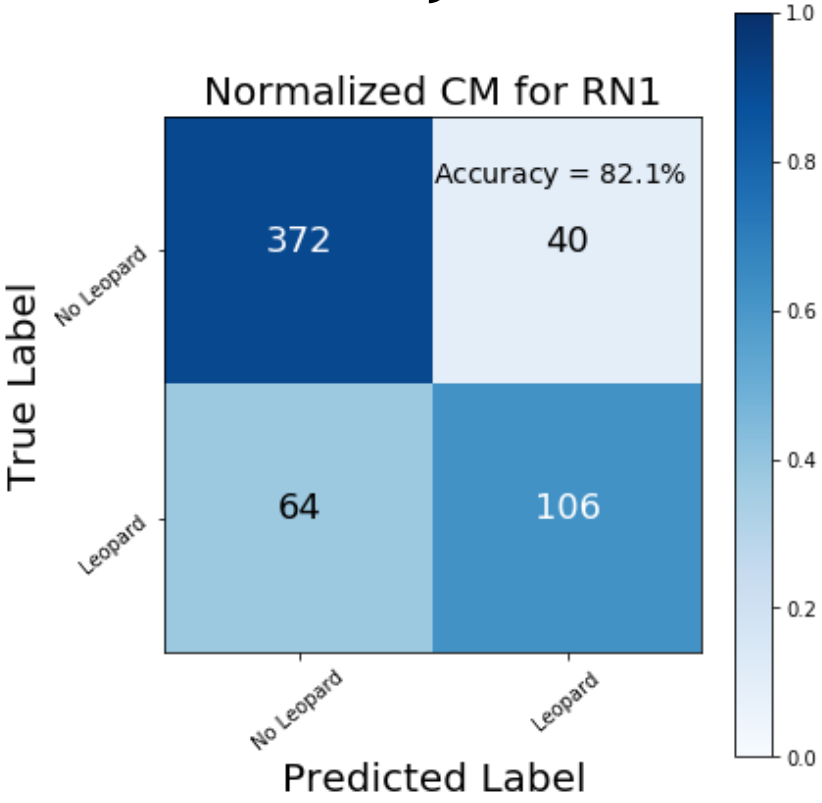


Performance

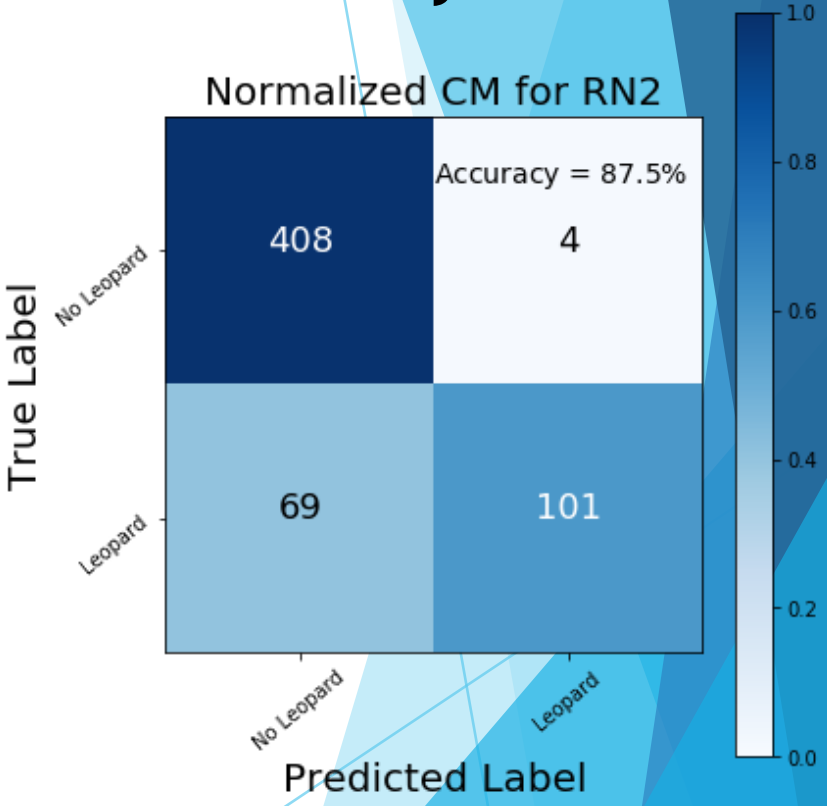
Accuracy 65.6%



Accuracy 82.1%



Accuracy 87.5%



Without Deep Featurization

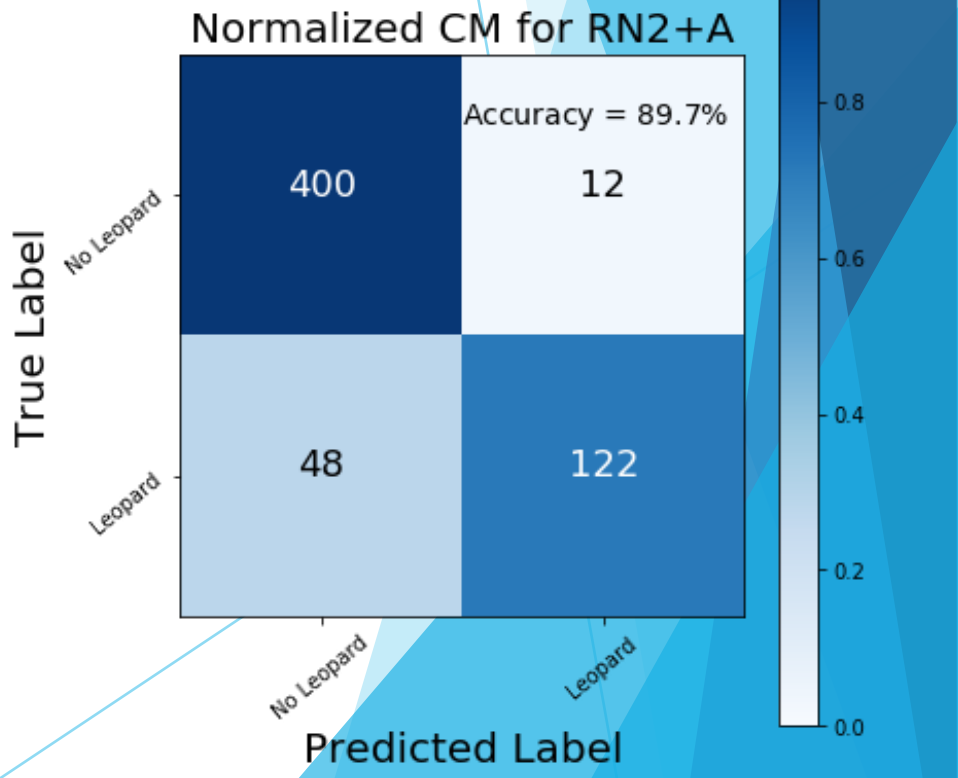
With Deep Featurization

Further Refinements

- Dataset Augmentation

```
ia = mml.ImageSetAugmenter(inputCol="images", outputCol="images")
pipe = Pipeline(stages=[ia, featurizer,classifier])
```

Accuracy 89.7%



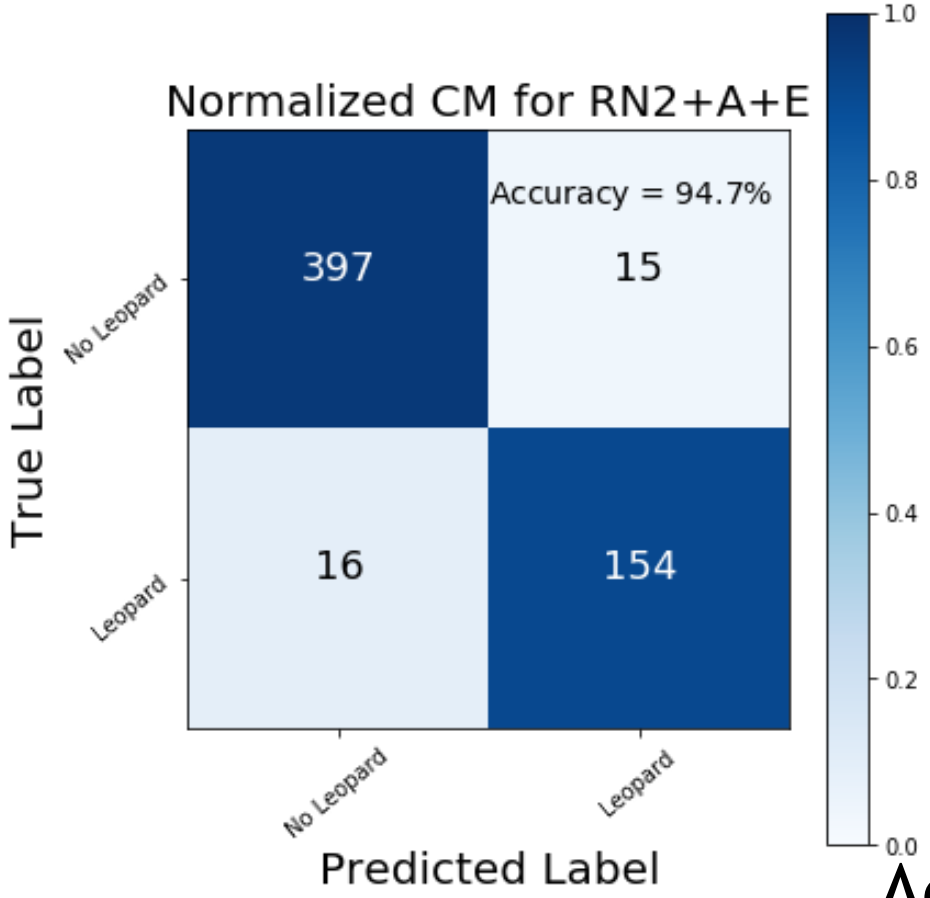

2012-06-30 9:03:10 PM M 1/5
24°C
RECONYX
SLT017

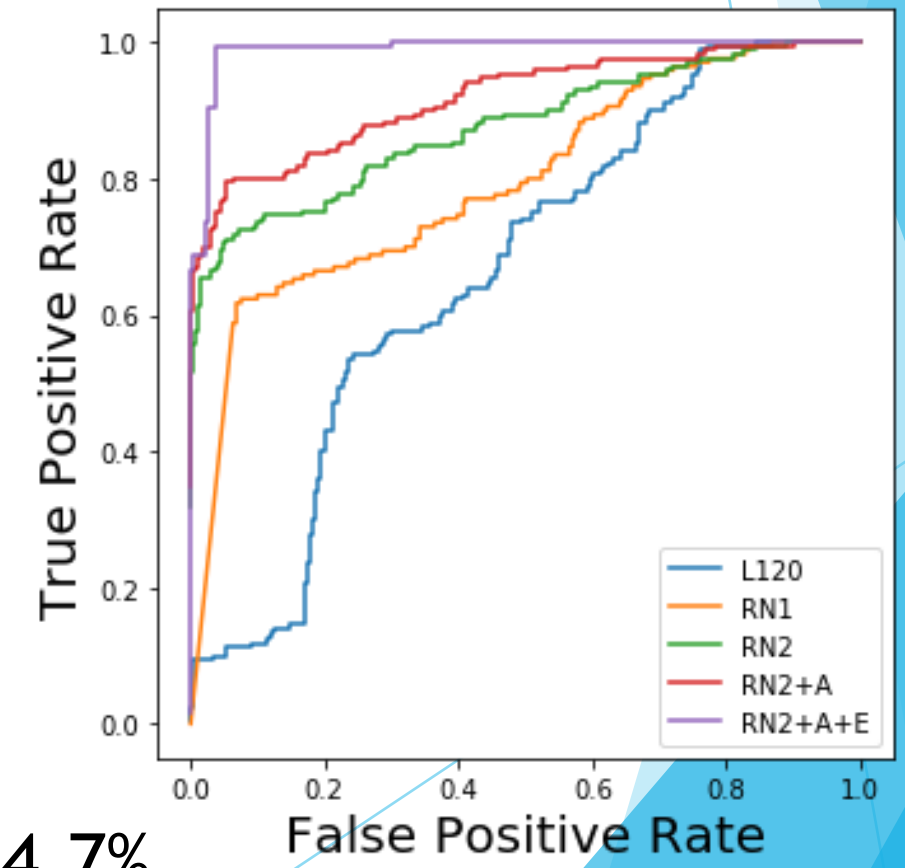

2012-06-30 9:03:11 PM M 2/5
24°C
RECONYX
SLT017


2012-06-30 9:03:12 PM M 3/5
24°C
RECONYX
SLT017

Ensembling over Sequences

```
ebk = mml.EnsembleByKey(
    keys=["group", "filename"],
    cols=["prob"],
    colNames=["mean(prob)"])
pipe = Pipeline(stages=[ia, featurizer, classifier, ebk])
```





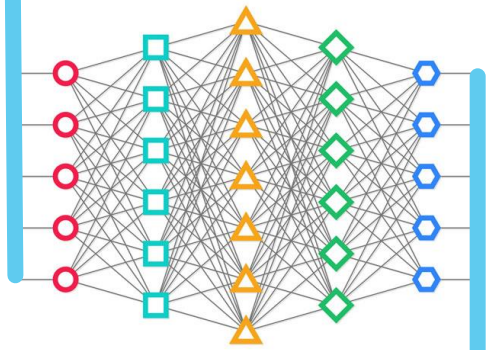
Accuracy 94.7%

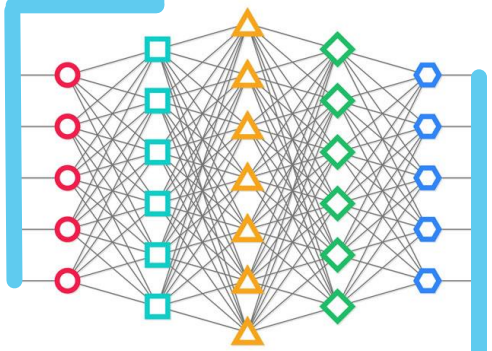
Azure Storage

Time

1 2 3 4 5

MMLSpark Streaming Pipeline





Time

1 2 3 4 5

PowerBI

Power BI | My Workspace > Snow Leopard Dashboard

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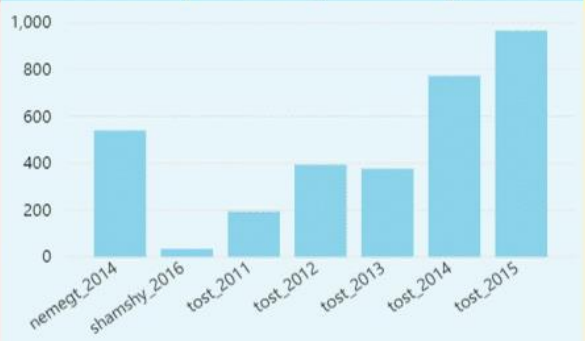
Total	Leopards	Other
51.88K	3274	48.61K



Survey Selector

- Select All
- nemegt_2014
- shamshy_2016
- tost_2011
- tost_2012
- tost_2013
- tost_2014

FILTERS

Page 1

Going Forward

(a) Original Image (b) Explaining *Electric guitar* (c) Explaining *Acoustic guitar* (d) Explaining *Labrador*

Figure 4: Explaining an image classification prediction made by Google's Inception network, highlighting positive pixels. The top 3 classes predicted are "Electric Guitar" ($p = 0.32$)**, "Acoustic guitar"** ($p = 0.24$) **and "Labrador"** ($p = 0.21$)

Thanks to

- Snow Leopard Trust: Koustubh Sharma, Jeff Brown, Michael Despines
- MMLSpark Team: Sudarshan Raghunathan, Ilya Matiach, Tong Wen, Eli Barzilay, Ben Brodsky
- AI for Earth Program, CNTK Team
- All others who made this work possible

www.snowleopard.org