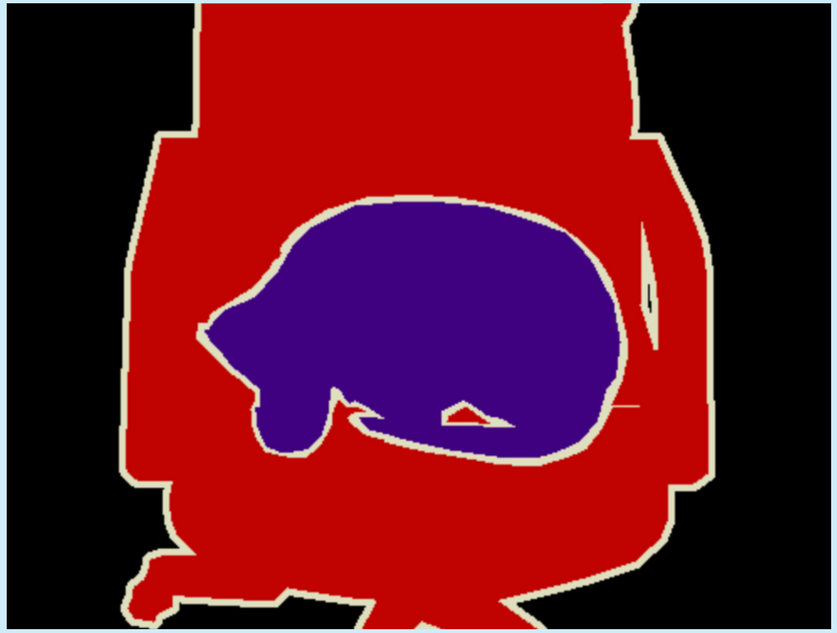
Show and Tell

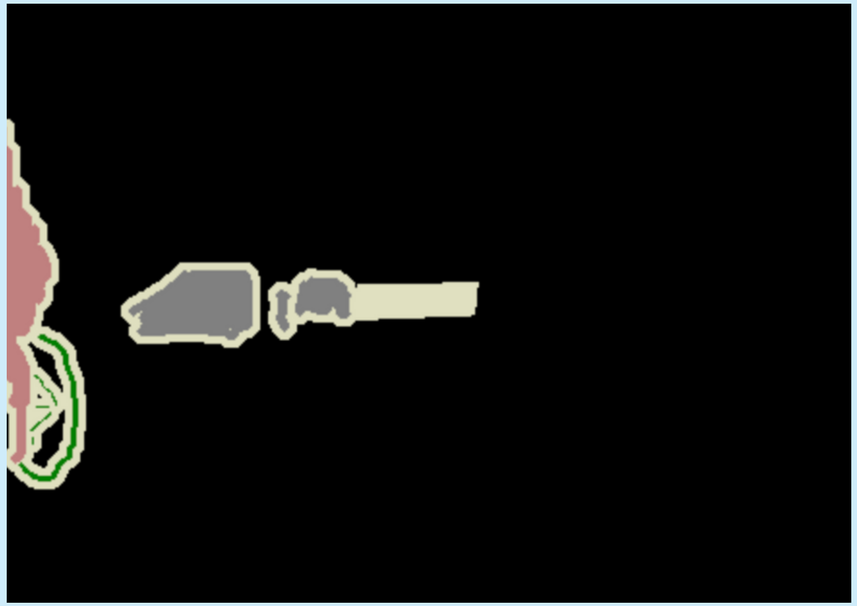
A Neural Image Caption Generator

Paper Implementation, AMMI '21

by 'Lekan Raheem

What Do You See?





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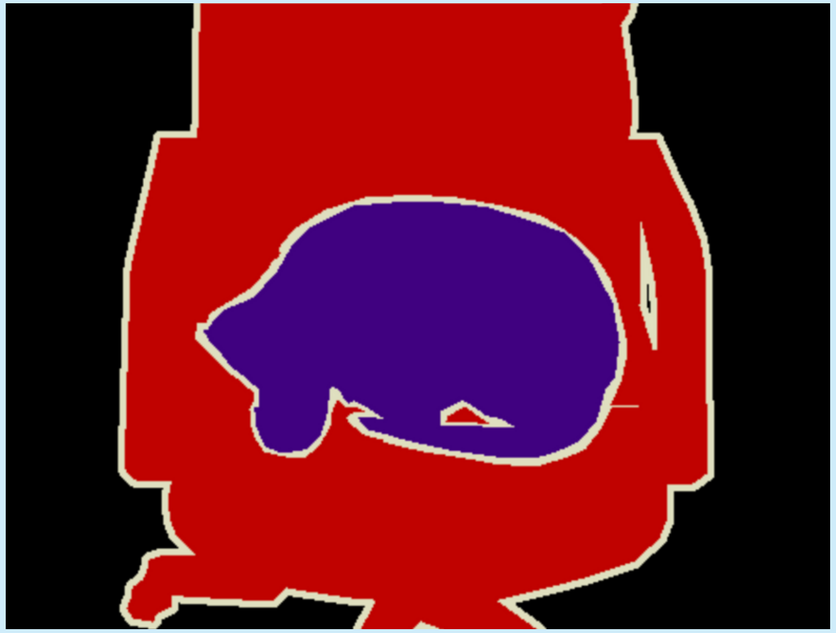

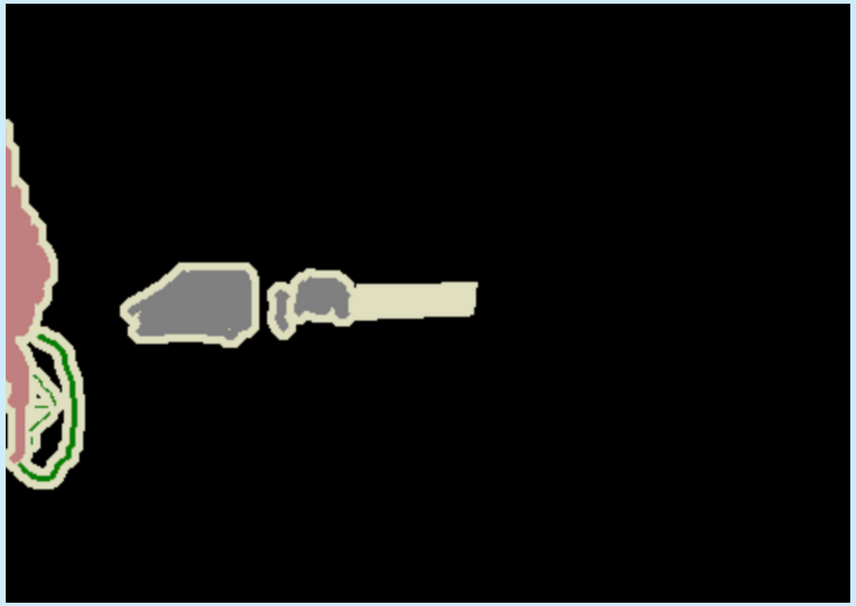

The Process of Image Captioning

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1

Object Recognition

What objects are in our picture?

The Process of Image Captioning

1

Object Recognition

What objects are in our picture?

2

Object Description

Color, posture, size etc.

The Process of Image Captioning

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Object Recognition

What objects are in our picture?

2

Object Description

Color, posture, size etc.

3

Position of Objects

Where is each object?

The Process of Image Captioning

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Object Recognition

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Object Description

Color, posture, size etc.

3

Position of Objects

Where is each object?

4

Relate all Objects in Image

The relationship!

Possible Captions...

1

Three people are in a canoe on a calm lake with the sun reflecting yellow

2

Three people are on a boat in the middle of the water while the sun is in the back

3

Three people in a boat float on the water at sunset

4

Sunset with three people in a boat on the lake, one holds a paddle

Model?

How do we do this?

The Process of Caption Generation

1

Pretrained on ImageNet

Object recognition

2

Feature Extraction

features of image

2

Preprocess Captions

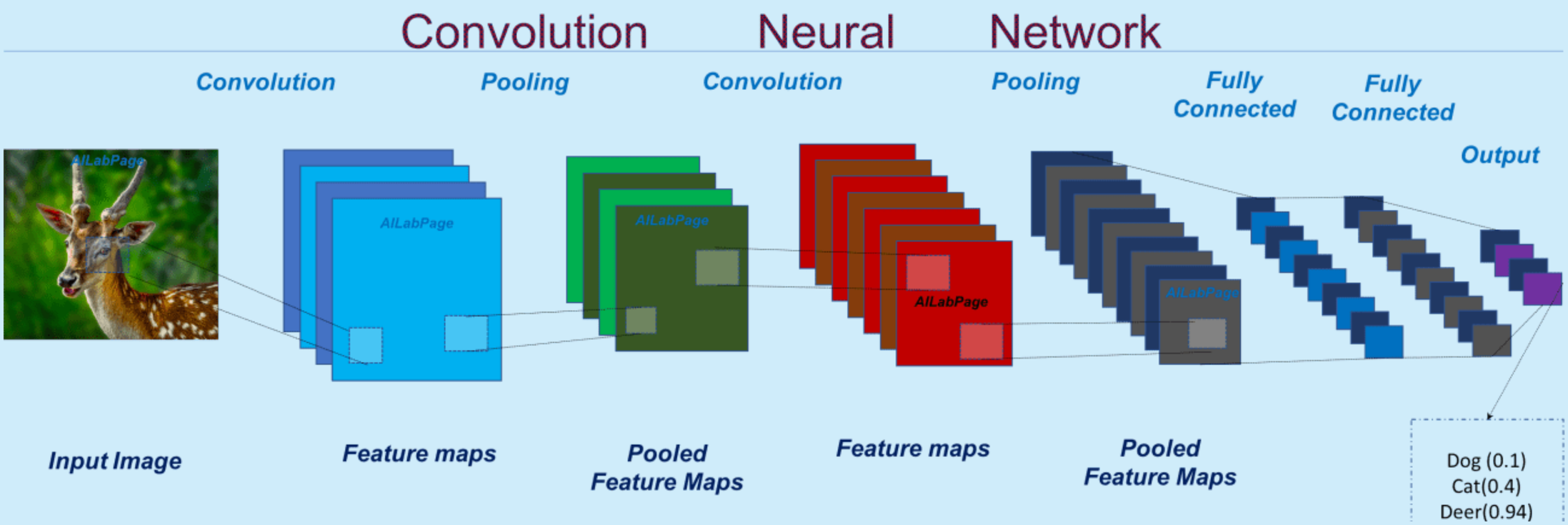
tokenize, SOS, EOS

3

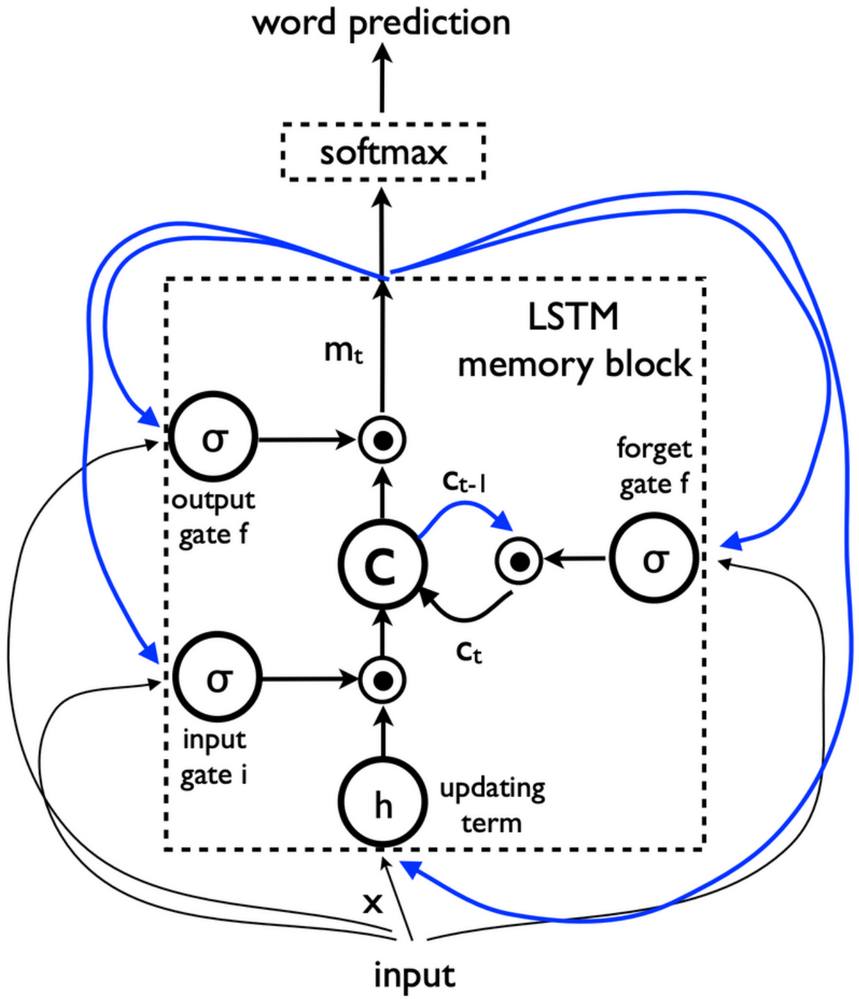
Recurrently Train

Show feature map iteratively

Feature Extraction



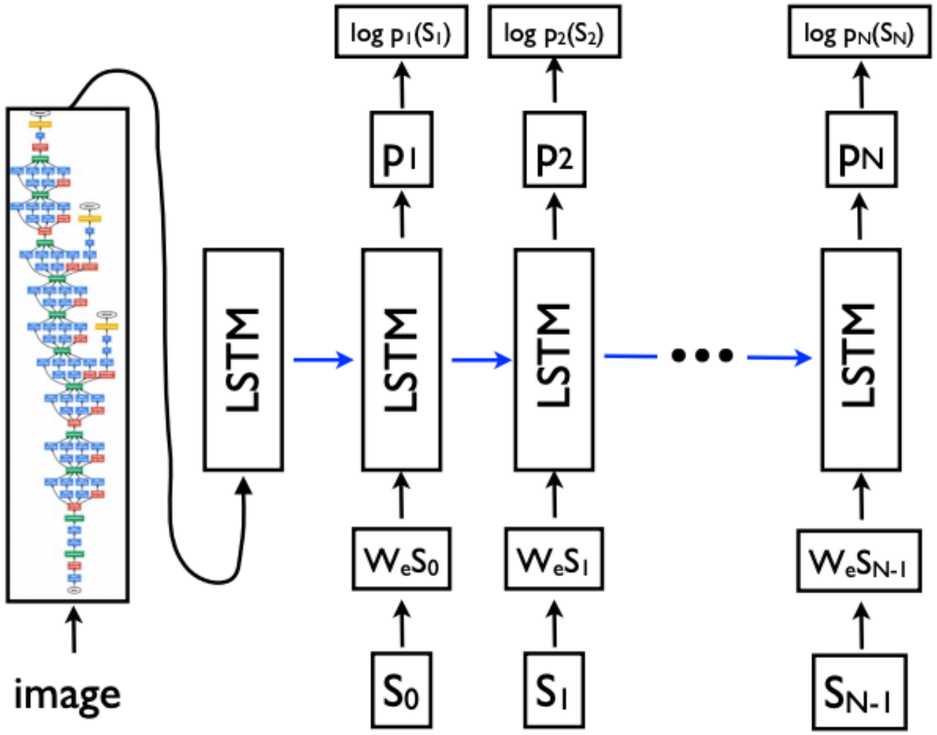
Generating each word



$$
\begin{aligned}
i_t &= \sigma(W_{ix}x_t + W_{im}m_{t-1}) \\
f_t &= \sigma(W_{fx}x_t + W_{fm}m_{t-1}) \\
o_t &= \sigma(W_{ox}x_t + W_{om}m_{t-1}) \\
c_t &= f_t \odot c_{t-1} + i_t \odot h(W_{cx}x_t + W_{cm}m_{t-1}) \\
m_t &= o_t \odot c_t \\
p_{t+1} &= \mathrm{Softmax}(m_t)
\end{aligned}
$$

Iterative Training

We train from SOS till EOS



$$
\begin{aligned}
x_{-1} &= \mathbf{CNN}(I) \\
x_t &= W_e S_t, \quad t \in \{0 \dots N-1\} \\
p_{t+1} &= \mathbf{LSTM}(x_t), \quad t \in \{0 \dots N-1\}
\end{aligned}
$$

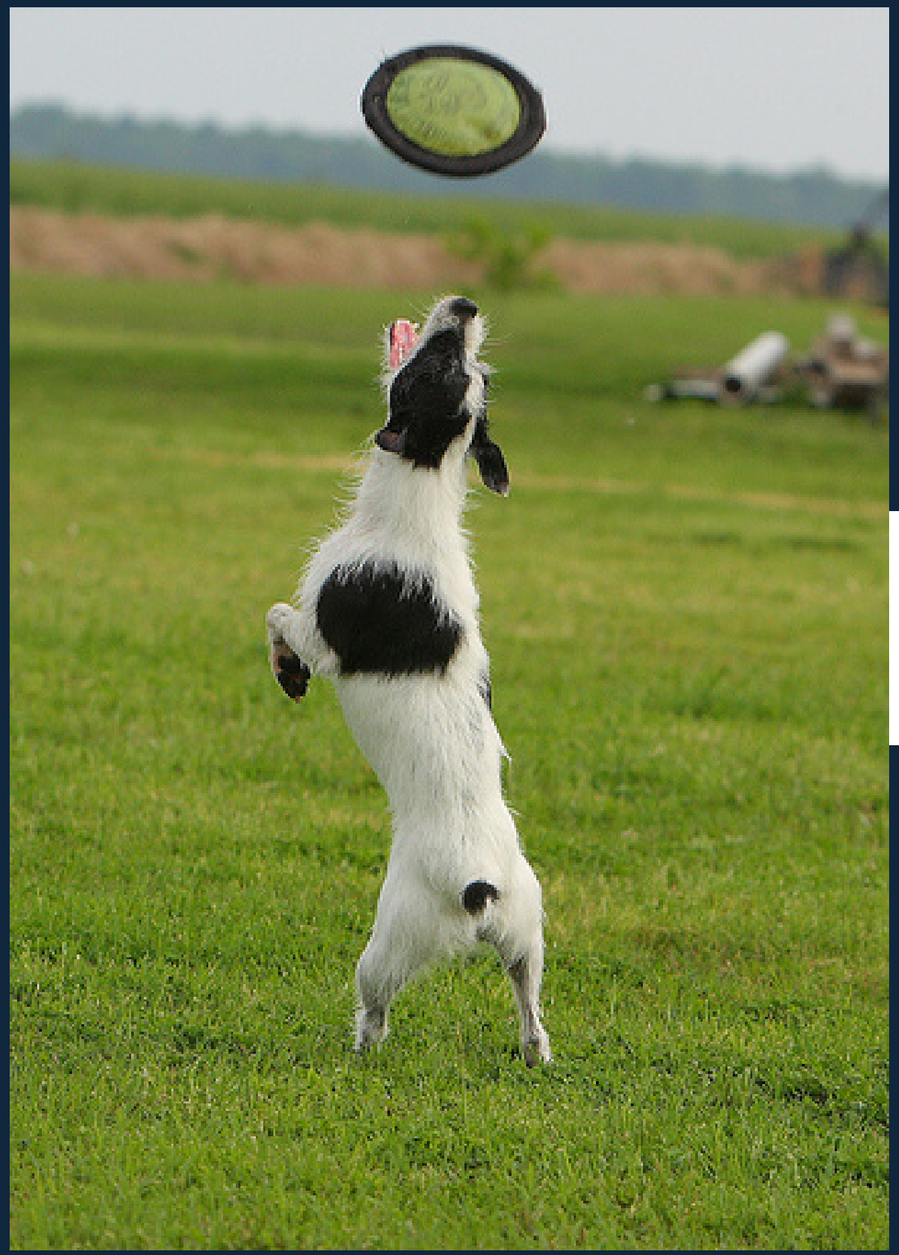
Really!

Thats all it takes?

That was Close!

```
**************************************************************
Predicted caption -> <sos> brown dog is sitting <eos>

Actual caption -> <sos> brown dog is sitting in some long grass <eos>
**************************************************************
```



Not really!

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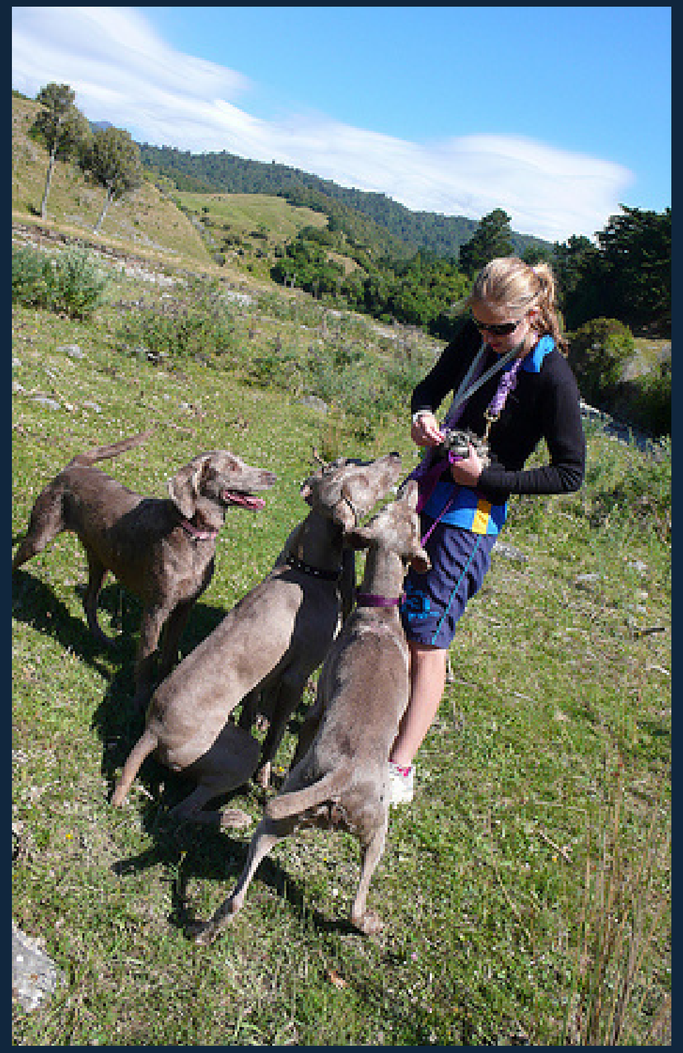
**********************************************************************

Predicted caption ->  startseq black and white dog is jumping over hurdle end

Actual caption ->  startseq black and white dog is playing with ball on lawn
**********************************************************************
```



Misfire!

```
**********************************************************************

Predicted caption ->  startseq man in red shirt is standing on skateboard in the snow

Actual caption ->  startseq girl holds something while three dogs beg endseq
**********************************************************************
```

Thank You!

Questions