Major Project

Melanoma Detection: An Automated Approach

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Problem Statement

Automated Diagnosis of melanoma through processing of digital images of skin lesion.

Existing Methods

A typical workflow:

1. Imaging
   a. Obtaining the desired dataset
2. Pre processing
   a. Removal of noise as neede
3. Feature Extraction
   a. BoVW, Codebooks
   b. Sparse Coding
   c. DNN
4. Classification
   a. CNN
   b. SVM

Results

METHODS	ACCURACY	SPECIFICITY
Sparse Coding	72.7%	81%
Deep Learning [caffenet]	77.6%	80%

Reinforcement Learning

IDEA

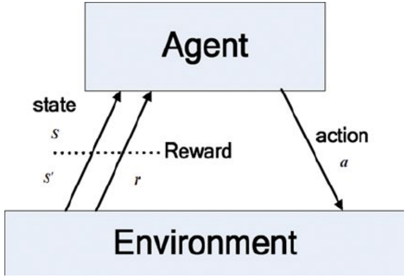
To construct a minimal deep learning network that achieves good accuracy and sensitivity and is well suited for skin lesion images.

Constructive Learning

Deconvolve

Reinforcement Learning

Decision making



Elements: a *policy*, a *reward function*, a *value function*, *state space, DQN parameter(theta)*

Concept: Exploration versus Exploitation

Approaches:

1. Assign values to states and use this to determine next step to maximize ultimate outcome.
   This uses holistic input from the environment
2. Learn values of state-action pairs (Create intrinsic value)
   Does not require a model of the environment (except legal moves)
   Cannot look ahead

Constructive Learning

Constructive Neural Network Learning Algorithms for Pattern Classification

- Avoids the need for ad hoc and often inappropriate choices of network topology
- Provides attractive framework for the
  - incremental construction of near-minimal neural network architectures.
  - Network pruning
- Incorporating problem-specific knowledge into initial network configurations and for modifying this knowledge using additional training examples
- Binary to Binary mapping algos: tower , pyramid , tiling , upstart , oil-spot , and sequential algorithms.
- We use Reinforcement Learning based Policy for building the network.

Deconvolve

Understanding the neural network

Visualization of the learning process

- Because the optimization is stochastic, by starting at different random initial images, we can produce a set of optimized images whose variance provides information about the invariances learned by the unit. As a simple example, we can see that the pelican neuron will fire whether there are two pelicans or only one.

Model

Assumptions:

- High error in a layer is due to
  - Insufficient input (inc. number of nodes)
  - Need for more abstraction (add a layer)
- High performing layers will be tested by removing a node to identify extraneous parts
- Error function to determine if the cnn has responded positively to the change is Accuracy.

Model

ACTION SPACE:

- Scale Up
- Scale Down

STATE SPACE

- Tiling states and the CNN

Model

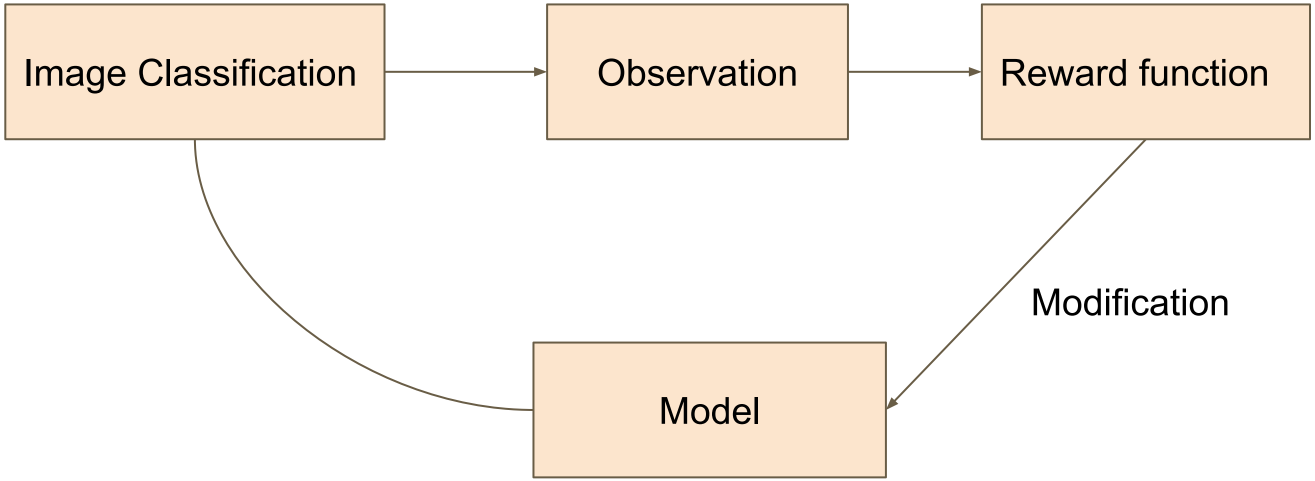


Image Classification
Observation
Reward function
Modification
Model