NTNU - Norges teknisk-naturvitenskapelige universitet
Institutt for bioteknologi og matvitenskap

BACHELOROPPGAVE 2020

20 studiepoeng

Bruk av maskinsyn for deteksjon av ulike fiskearter

(ev. bilde/illustrasjon)

utført av

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0.1 Innledning – bakgrunn for oppgaven

0.2 Teori

0.2.1 Introduksjon til kunstig intelligens

0.2.2 Maskinlæring

Machine Learning: Learning from data

Data is king.

Data collection, annotation, preporation etc.

Data ¿ Algorithm ¿ Training ¿ Evaluation ¿ Deployment ¿ Predictions

Gather data from every legal source possible (public data sets, purchase data, collect data, synthesize data (super poweful))

Manually check data Look for biases Look for insights Clean up

Iterative: Partition data 60 (training)/20 (testing accuracy training)/20 (test)

Model / Algorithm

Image classification Object detection Segmentation

Constraints

Experimentation (test multiple viable models)

Training

Data augmentation Training parameter (optimizer, rate etc.) Visualizsation (check if it is going correctly)

Evaluation

Test. Check model size, speed and ACCURACY

Deployment

Optimizations, deploy, feedback (know when it went badly, check failed images)

0.2.3 Neural networks

Classification (Supervised learning)

Seperating data into groups

Binary classification (two groups) (Sigmoid activation is used)

Multiclass classification (Activation: Softmax) (Loss function: Cross entropy loss)

Regression (Activation: Linear) (Loss function: MSE loss)

Decision boundary seperates the groups by the decision function

Training is learning the decision function

Deciding decision function is called training

Data is on a plane (2D) or a hyperplane (higher dimensions)

Input layer ¿ Hidden layer (can be many layers) ¿ output

Each layer (node) in a nn is a neuron or perceptron

Perceptron: Calculate weighted sum of inputs and add bias. Then apply activation function (non-linear)

Every layer looks for a pattern found in the previous layer. If it is found, it fires up"

An example of an activation function is ReLU (Rectified Linear Unit)

Another example is the sigmoid function, and tanh

An activation function creates non-linearity

The number of hidden layers is called the networks depth (depth = 2 is typical for simple problems)

Loss functions

Classification outputs a category (class)

Regression outputs numerical values (or a vector of numerical values)

Many problems are optimizatino problems in ML, either to minimize or maximaze a value of a function

These functions are called the objective function

When finding the minimum, it is called a loss, or cost, function

e = y - $\hat{y}$ (error is ground thruth minus model output)

An error, L, can be considered either a square (MSE, most common) or an absolute number (MAE, when data has many outliers)

Single layer perceptron kan løse lineære problemer

Ved å gjøre feature engineeringså kan ikke-lineære problemer løses

Deep learning gjør at en kan løse lineære problemer om en bruker ikke-lineær aktivering. ReLU konvergerer raskt.

0.2.4 Maskinsyn med OpenCV

0.2.5 Video med undervannskamera fra merdene

0.2.6 Analysere video

0.2.7 Deep Learning med OpenCV

0.2.8 PyTorch

0.2.9 Segmentere ut fisk

0.2.10 Object Detection med OpenCV

0.2.11 Object Tracking med OpenCV

0.2.12 Klassifisere hver fisk etter art

0.2.13 Registrere antall individer av hver art fortløpende

0.3 Praktisk gjennomføring

0.3.1 Programvareutvikling med maskinlæring implementert i C++

0.3.2 Videostrøm fra merdene

0.4 Resultater

0.5 Diskusjon

0.6 Konklusjon

0.7 Referanseliste