

Computational Intelligence Methods

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*notes form lectures MIE-MVI/FIT/CTU

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Abstract

Definitions, terms and knowledge from course NI-MVI.

1 Introduction

What is intelligence

Evolutionary

Genotype fenotype

- fitness function

Significant fields

- self-driving cars
- intelligent assistants

- general artificial intelligence (play game from visual input)

Research at Datalab

prg.ai

ethics

2 Machine Learning

History

- 1940
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010

GAN

Transformers (pros of conv + recu)

- 2020+

AutoML in RL

Machine learning tasks

- regression / prediction
- classification / recommendation
- clustering /
- problem solving / planning / control

2.1 Types learning

- supervised
- unsupervised
- semisupervised
- Active learning
- transfer learning
- few-shot learning
- meta-learning / continual learning

Examples by types

Measuring the performance

Learning systems

Defining learning task

- T - task ()
- P - performance
- E - experience

Design learning system

- database, prepare data
- choose what to be learnt - target function
- choose representation of target function
- choose learning algorithm
- supply algorithm with performance metric

Checkers example

Building the database

- Direct experience
set of board with correct move
- indirect experience
sequences of game moves and final results

Choose target function

- $\text{chooseMove}(\text{board}, \text{legalMoves}) \rightarrow \text{bestMove}$
- $V(\text{board}) \rightarrow R$ (how favorable position) - can be applied for all legal-Moves

Choose target function representation

Machine learning methods

Ants AI challenge

3 Evolutionary Algos

4 Neural Networks

Overview

- Introduction to artificial neural networks
- Perceptron, gradient learning
- MLP, Back-propagation of error
- Unsupervised training - SOM

4.1 Perceptron

4.1.1 Perceptron training

4.1.2 Perceptron gradient learning

4.1.3 Deriving gradient of error

4.1.4 Cross entropy loss

4.2 Backpropagation algorithm

4.2.1 Multilayer perceptron – MLP

4.2.2 Chain rule and backprop

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4.4 MLP as universal approximator

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5 Convolutional Networks

6 Text and Graph Embeddings

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8 Neuroevolution

9 Recurrent Neural Nets⁷

10 Metalearning

11 CMAES and Swarm Optimisation