# The Memory Capacity of Neural Networks

### **Course:** Seminar/Project Machine Learning & Neuroinformatics/Brain-Computer Interfacing (708.415)

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## Introduction

This project aims to investigate the memory capacity of neural networks. Unique input and output patterns are handed to the network to be learned. Two different network architectures are tested and two different definitions of when a pattern is learned correctly are analyzed.

## Methods

### Data

The input and target vectors are binary vectors of size N. They have a sparsity s which was chosen as 0.1. This means that 10% of their bits were ones and the rest were zeroes. Both vectors were generated randomly, but no duplicates were allowed within the input and output matrix respectively.

### Network

The first network used was a 1-Layer fully connected network.  
BCE Loss  
ADAM optimizer

The second network expanded the first network by a recurrency.  
straight connections disabled

Different Losses & Classification

1. 100% correct
2. Tolerance = 0.1: bits\_to\_ignore = N \* sparsity \* tolerance …. bits\_to\_ignore of active bits and bits\_to\_ignore of inactive bits are ignored for loss calculation classification. The bits\_to\_ignore highest losses of active and inactive bits respectively are set to 0, preventing weight updates. This was done to help the network correctly memorize patterns that randomly overlap partially.

… with rising N => more neurons, but also bigger/more complex data.

## Results

## Discussion

Daten warden auch komplexer mit steigendem N und es gibt stochastisch daher immer mehr overlap zwischen den patterns, was es viel schwieriger macht sie perfekt zu lernen. Viele der Verbindungen die man dazugewinnt mit mehr neuronen sind nicht benötigt, und da wo man sie braucht hat man sie dann trotzdem nicht.

Ein Bild, das Text, Reihe, Diagramm, parallel enthält.

Automatisch generierte Beschreibung

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