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**TODO Titel**

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Design Your Own CPU - Design of Embedded Systems

## Content

### 1. Neural Networks

### 2. BNN Design

### 3. BNN Training Analysis

- Layer Analysis
- Parameter Analysis

## Binarisation of Linear Layer

Inhalt...

## Activation

Inhalt...

## Batch Norm (BN)

- In NN

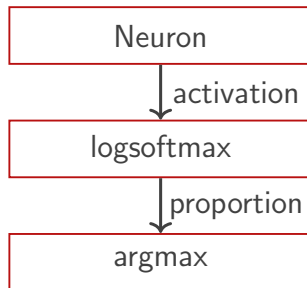
- normalize batches
- mean 0
- standard derivation 1

- In BNN

- prevent expolding gradient

## Evaluation of last layer

- normalisation of activation
- decision of the network



## 1. Neural Networks

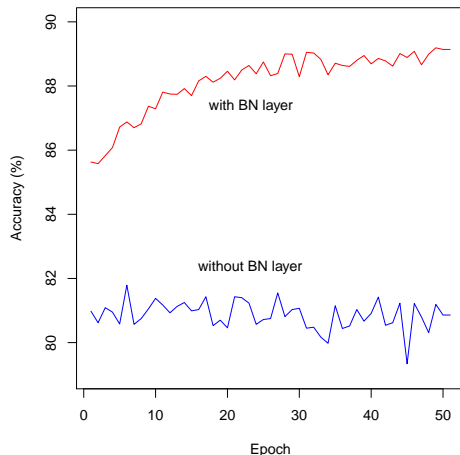
## 2. BNN Design

## 3. BNN Training Analysis

- Layer Analysis
- Parameter Analysis

## Effect of Batch Norm

- 7.4% improved peak performance
- Less jitter with BN
- Reduced exploding gradient





## Consequences of linear layer binarisation

Run	binary	normal
1	88.29%	97.43%
2	87.32%	96.98%
3	87.19%	97.2%

■ TODO

## learning rate

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