

# Classification with Restricted Boltzmann Machines

## Projects in Machine Learning and AI

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# Table of Contents

- 1 Theory
  - Boltzmann Machines
  - Restricted Boltzmann Machines
  - Contrastive Divergence
- 2 Implementation
- 3 Results



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# Sample frame title

A bit more information about this

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# Some useful math equations

$$E(\mathbf{v}, \mathbf{h}) = \sum_{i=1}^V \frac{(\mathbf{v}_i - \mathbf{b}_i^v)^2}{2\sigma_i^2} - \sum_{j=1}^H \mathbf{b}_j^h \mathbf{h}_j - \sum_{i=1}^V \sum_{j=1}^H \frac{\mathbf{v}_i}{\sigma_i} \mathbf{h}_j \mathbf{w}_{ij} \quad (1)$$

$$p(\mathbf{v}, \mathbf{h}) = \frac{e^{-E(\mathbf{v}, \mathbf{h})}}{\sum_{\mathbf{x}} \sum_{\mathbf{k}} e^{-E(\mathbf{x}, \mathbf{k})}} \quad (2)$$



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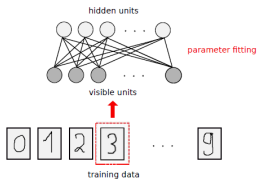
# Implementation

RBM	
- NumOfVisibleUnits	: int
- NumOfHiddenUnits	: int
- VisibleBiases	: float
- HiddenBiases	: float
- Weights	: float
+ train ()	
+ sample ()	

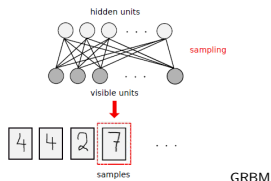


DRBM	
- NumOfTargetUnits	: int
- TargetBiases	: float
- WeightsVH	: float
- WeightsTH	: float
+ <<Override>> train ()	
+ <<Override>> sample ()	
+ predict ()	

## learning

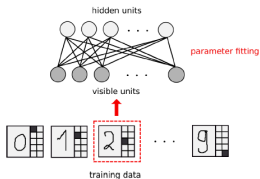


## generating

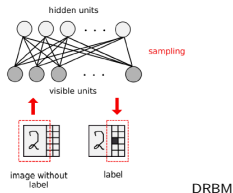


Source: A.Fischer, Ch.Igel: Training Restricted Boltzmann Machines: An Introduction

## learning with labels



## classification



Source: A.Fischer, Ch.Igel: Training Restricted Boltzmann Machines: An Introduction

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# Further Reading I



A. Autor.

*Introduction to Giving Presentations.*

Klein-Verlag, 1990.



S. Jemand.

On this and that.

*Journal of This and That*, 2(1):50–100, 2000.

