Europass Curriculum Vitae

Personal information

Surname(s) / First name(s)	**Houben, Akke Mats**
Address(es)	Hoefbladhof 63 3991GG Houten The Netherlands
Telephone(s)	+316 4444 6994
Email(s)	akkehouben@gmail.com
Nationality(-ies)	Dutch
Date of birth	10-04-1991
Gender	Male

Education and training

Dates	2017 - present
Title of qualification awarded	**Master research in Behavior and Cognition** (60ECTs)
Principal subjects	- Computational modeling of neurons, networks, behavior and cognition - Neuroscience, cognition and brain functioning - Neuroimaging and (neuronal) data analysis - Research methodologies
Organising institute	*Faculty of Psychology* *University of Barcelona* *Spain*
Level of qualification	EQF level 7
Dates	2013 - 2017
Title of qualification awarded	**Bachelor in Music and Technology** (180ECTs)
Principal subjects	- Programming - (Digital) Signal Processing - Soundperception & -cognition - Research
Thesis	A biologically inspired audio transformation: computational model of A1 neuron receptive field formation and function
Organising institute	*Faculty of Music and Technology* *Utrecht University of the Arts* *The Netherlands*
Level of qualification	EQF level 6
Dates	2016 - 2017
Title of qualification awarded	**Honours track Ba Music and Technology** (10ECTs)
Organising institute	*Faculty of Music and Technology* *Utrecht University of the Arts* *The Netherlands*
Level of qualification	EQF level 6

Dates	April - July 2017
Title of qualification awarded	**Extracurricular: Neural Noise and Neural Signals**
Principal subjects	- Models and measures of neural noise - Nonlinear dynamics, stochastic processes and information theory
Organising institute	*Technical University of Berlin* *Germany*
Level of qualification	EQF level 7
Dates	April - July 2017
Title of qualification awarded	**Extracurricular: Machine Intelligence II (unsupervised methods)**
Principal subjects	- Unsupervised machine learning methods - Analysis of machine intelligence algorithms
Organising institute	*Technical University of Berlin* *Germany*
Level of qualification	EQF level 7
Dates	November - December 2016
Title of qualification awarded	**Extracurricular: Bayesian Statistics**
Principal subjects	- Conditional probabilities - Bayesian inference & regression - Data analysis
Organising institute	*Coursera / Duke University* https://www.coursera.org/learn/bayesian
Level of qualification	Coursera course
Dates	September - November 2016
Title of qualification awarded	**Extracurricular: Machine Learning Course**
Principal subjects	- Bias-variance analysis of algorithms - Bayesian learning, regression models & neural networks - Implementations in Java
Organising institute	*Utrecht University* *The Netherlands*
Level of qualification	EQF level 6
Dates	September - November 2016
Title of qualification awarded	**Extracurricular: Logic course**
Principal subjects	- Logic for Artificial Intelligence - Set theory - Predicate & Propositional Logic - Proof by Induction - Natural Deduction
Organising institute	*Utrecht University* *The Netherlands*
Level of qualification	EQF level 6
Dates	2014 - 2015
Title of qualification awarded	**Extracurricular: Audio Signal Processing for Music Applications**
Principal subjects	- Fourier-based signal processing & analysis
Organising institute	*Coursera / Universitat Pompeu Fabra of Barcelona & Stanford University* https://www.coursera.org/learn/audio-signal-processing
Level of qualification	Coursera course

Dates	2012 - 2013
Title of qualification awarded	**Preparatory course Music and Technology**
Principal subjects	- Preparation for Music and Technology studies
Organising institute	*Faculty of Music and Technology* *HKU University of the Arts* *The Netherlands*
Dates	2011 - 2012
Title of qualification awarded	**Several courses of Ba Science**
Principal subjects	- Mathematics - Programming - Physics - Organic chemistry
Organising institute	*Radboud University Nijmegen* *The Netherlands*
Level of qualification	EQF level 6
Dates	2011 - 2012
Title of qualification awarded	**Extracurricular: Biology course**
Organising institute	*ROC Midden Nederland* *The Netherlands*
Level of qualification	EQF level 4
Dates	2009 - 2010
Title of qualification awarded	**Several courses of Ba Psychology**
Principal subjects	- Anatomy of brain and nervous system - Neurophysiology - Study of perception - Psychological research methods
Organising institute	*Tilburg University* *The Netherlands*
Level of qualification	EQF level 6
Dates	2003 - 2009
Title of qualification awarded	**Preparatory Scientific Education (VWO)**
Organising institute	*College de Heemlanden* *The Netherlands*
Level of qualification	EQF level 4

Work experience

Dates	2016 - 2017
Occupation or position held	**Junior Software Developer**
Main activities	- Software development - Database management - GUI/UI & UX development - Python - .NET/Jscript - SQL
Name and address of employer	*DDL Diagnostic Laboratory BV* *Visseringlaan 25* *2288ER Rijswijk* *The Netherlands*
Type of business or sector	Bio-informatics & Next Generation Sequencing

Dates	2015 - 2016
Occupation or position held	**Intern at Music Technology Group**
Main activities	- Research on pitch estimation and perception - Analysis of sound corpus - Programming
Name and address of employer	*Music Technology Group* *Universitat Pompeu Fabra* *Roc Boronat, 138* *08018 Barcelona* *Spain*
Type of business or sector	Research and Development
Dates	2014 - 2015
Occupation or position held	**Student Delegate at Participation Council**
Main activities	- Representation of students to executive board
Name and address of employer	*Utrecht University of the Arts* *PO-BOX 2471* *1200CL Hilversum* *The Netherlands*
Type of business or sector	Research and Education
Dates	2014 - 2015
Occupation or position held	**Student Assistant Teacher**
Main activities	- Assisting first-year programming classes (LISP & Processing) - Teaching second-year programming classes (C++)
Name and address of employer	*HKU University of the Arts* *PO-BOX 2471* *1200CL Hilversum* *The Netherlands*
Type of business or sector	Research and Education
Dates	2012 - 2013
Occupation or position held	**Administrative Assistant**
Main activities	- Data entry into database - Customer service assistant
Name and address of employer	*RHC Dealergroep BV* *Reactorweg 160* *3542AD Utrecht* *The Netherlands*
Type of business or sector	Distribution of medical equipment

Personal skills and competences

Mother tongue(s) **Dutch**

Other language(s) English, German & Spanish

Self-assessment *European level*(*)	**Understanding**		**Speaking**		**Writing**
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
German	B1	B2	A2	A2	B1
Spanish	A2	A2	A1	A1	A2

(*) *Common European Framework of Reference (CEF) level*

Skills and Competences

Programming

- Python: advanced
- C++: advanced
- Matlab/Octave: advanced
- Bash (scripting): advanced
- Linux: advanced
- LateX: advanced
- Scheme: advanced
- R: advanced
- Java: intermediate
- .NET: intermediate
- Jscript: intermediate
- SQL: intermediate
- CLisp: beginner
- Fortran: beginner

See also annex 4

Research

- **Trained in neurological research methods**: courses of Ba Psychology and Msc Research in Behavior and Cognition
- **Trained in computational modeling of (spiking) neural networks**: Msc Research in Behavior and Cognition & Msc thesis work
- **Skilled in investigating and understanding algorithms and their implementation**: Ba Music and Technology, Internship at Music Technology Group, Junior Software Development position, Msc Research in Behavior and Cognition & Msc thesis work
- **Used to perform (independent) research**: Msc thesis work, Internship at Music Technology Group & Ba Music and Technology

Creative

- Trained at coming up with creative solutions and ideas during several artistic and compositorial projects and art exhibitions undertaken during and before bachelor in Music and Technology, also in collaboration with a video artist, and during personal programming projects

Driving licence(s)

B

Main research interests

- Computational neuroscience & systems neuroscience
- Neuronal dynamics, oscillations, plasticity, adaption and organisation
- Formation and role of synchronous and a-synchronous states
- Dynamics of assemlby formation and their function

Current activities

- Communication through coherence and polychrony in spiking neural networks

Recent activities

- Modeling of neuronal structures of sound perception
- Neuronal coding/Population coding
- Self-organisation to obtain a natural population organisation

Annexes

Annex 1

Abstract of Ba thesis project: Biologically plausible computational model of A1 neuron spectrotemporal receptive field formation (publication in preparation)

Annex 4

Programming projects: https://github.com/akkeh

Annex 1

Biologically plausible computational model of A1 neuron spectro-temporal receptive field formation

https://github.com/akkeh/arfpop

Akke Houben*

Neurons of the primary auditory cortex (A1) are presented by sound signals split into frequency bands and integrate these signals spectro-temporally. It is thought that each neuron has a specific spectro-temporal receptive field (STRF) which can be seen as a spectro-temporal integration filter which determines its preferred stimulus and describes how the neuron responds to specific stimuli (Aertsen & Johannesma, 1981). It has been found that these neurons develop their STRFs under the influence of the auditory stimuli they receive early in postnatal development (Zhang, Bao, & Merzenich, 2001; Chang & Merzenich, 2003; Froemke & Jones, 2011) which also support the idea that a population of A1 neurons utilises the specific structure of their auditory environment and the stimuli which are behaviourally relevant to form an efficient coding of auditory events (Zatorre & Belin, 2001; Zhang et al., 2001; Young, 2008; Froemke & Jones, 2011; Santoro et al., 2014). Cross-modally it has been shown that an efficient coding principle is a coding in which only a small subset of a neural population is simultaneously active, thus a code in which the activation probability distribution of each individual neuron shows high kurtosis, this has been called a 'sparse code' (Field, 1994; Olshausen & Field, 2004).

Although it was not always the sole goal, there have been many studies that obtain these STRFs: there have been reverse correlation studies with either artificial (Shamma, Versnel, & Kowalski, 1995; Klein, Depireux, Simon, & Shamma, 2000; Depireux, Simon, Klein, & Shamma, 2001, e.g.) or natural (Theunissen, Sen, & Doupe, 2000; Calabrese, Schumacher, Schneider, Paninski, & Woolley, 2011, e.g.) stimuli or; purely mathematical approaches which assume the parameters of the neurons in the population (Chi, Ru, & Shamma, 2005, e.g.), assume the properties of the auditory environment or use a natural auditory environment but either utilised methods which are implausible to be used by natural neurons or do not obtain a sparse code (Athineos, Hermansky, & Ellis, n.d.; Zhao & Zhaoping, 2011; Carlin & Elhilali, 2013, e.g.). There have been systems proposed for other sensory modalities which use a biologically plausible learning system to obtain a population of sensory neurons (Antolík & Bednar, 2011, e.g.). In the auditory domain Coath et al. have modelled a network of auditory neurons and inferred their STRFs through a reverse correlation tech-

*akkehouben@gmail.com

nique, showing that STRFs emerge in a simulation of a network of neurons with a biologically motivated learning mechanism (Coath, Balaguer-Ballester, Denham, & Denham, 2008).

The system proposed in the current study tries to find a simple model which implicitly models the STRFs of A1 neurons with minimal assumtions about the underlying learning mechanism or morphology of the system other than that the A1 neurons: 1) adapt to the auditory environment; 2) give a joint representation of the auditory input space and; 3) have some tonotopical arrangement. In this way a simple, non axiomatic, though biologically plausible system of A1 neuron population STRFs generation is developed and assessed through which STRFs are obtained that show properties observed experimentally in A1. The system consists of a map of self-organising neurons which learn their respective STRFs from 'listening' to natural auditory stimuli and are able to represent sound signals with a sparse coding strategy. The system models a high level, abstract formation mechanism which maintains biological plausibility and in this way provides a framework within which it will be possible to further investigate the underlying low level formation mechanisms.

References

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Annex 1 (continued)

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