

# KI zwischen Hype und Anwendung

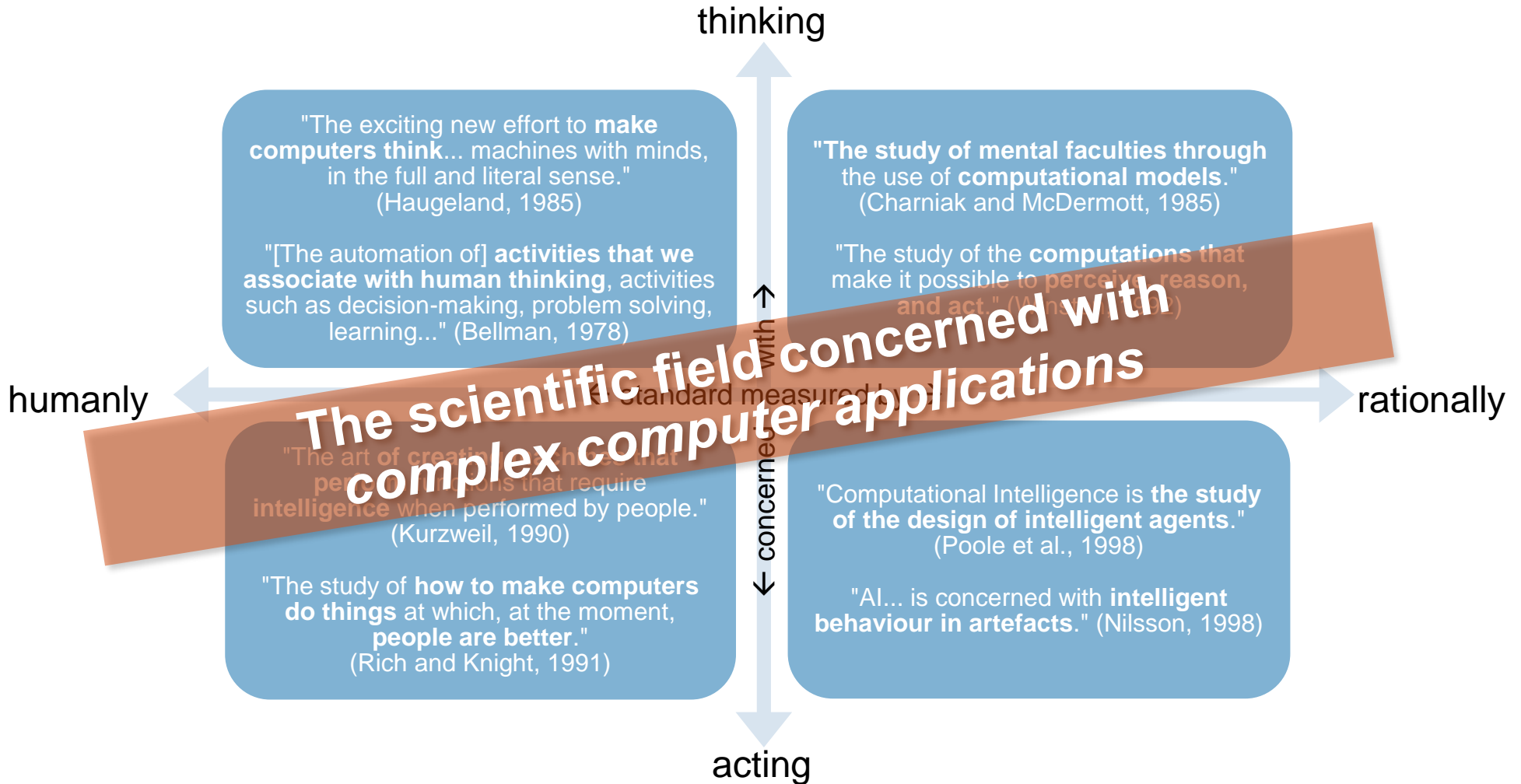
*Innovationsapero "Machine Learning – wie starte ich mein eigenes Projekt", Technopark Winterthur*

10. September 2019

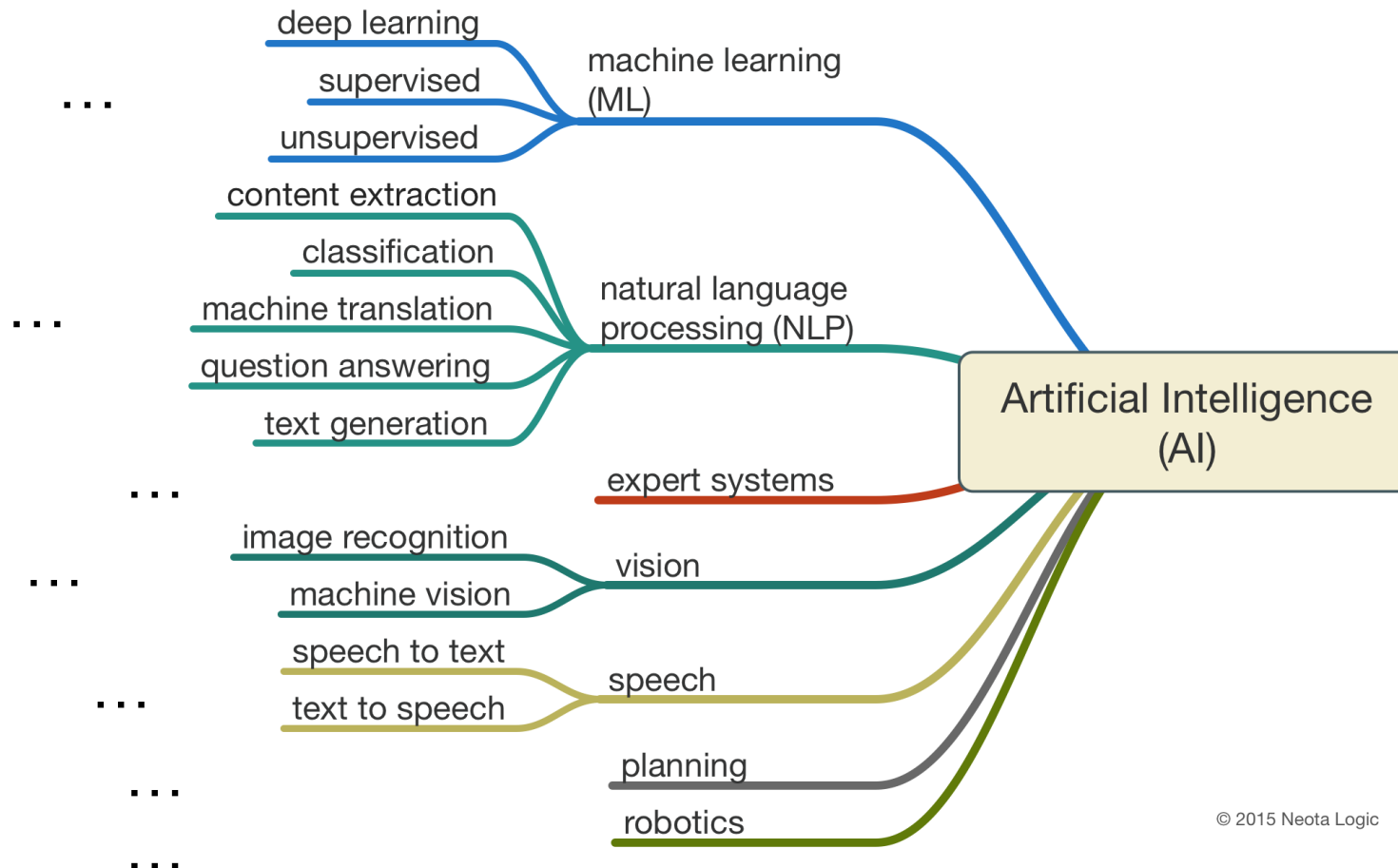
Thilo Stadelmann



# Was ist künstliche Intelligenz?



# Was gehört zu künstlicher Intelligenz?



© 2015 Neota Logic

# Warum der Hype?



arXiv monthly submission rates



**Forbes** Billionaires Innovation Leadership Money Consumer Industry Lifestyle

GPU TECHNOLOGY CONFERENCE

EUROPE / 9-11 OKTOBER, 2016  
DER WICHTIGSTE EVENT ZU KÜNSTLICHER INTELLIGENZ  
Sparen Sie 20% mit Code CM0SZM

25,677 views | Aug 20, 2016, 12:11am

## 10 Amazing Examples Of How Deep Learning AI Is Used In Practice?

**Bernard Marr** Contributor  
Enterprise & Cloud

You may have heard about deep learning and felt like it was an area of data science that is incredibly intimidating. How could you possibly get machines to learn like humans? And, an even scarier notion for some, why would we want machines to exhibit human-like behavior? Here, we look at 10 examples of how deep learning is used in practice that will help you visualize the potential.

**“The growth of deep-learning models is expected to accelerate and create even more innovative applications in the next few years.”**

# Idee «Deep Learning»: Mehr «Tiefe» zum automatischen Lernen von Merkmalen

Klassische Bild-  
verarbeitung

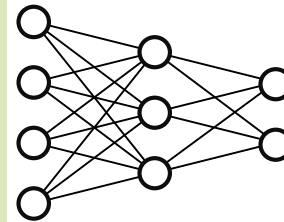


Merkmalsextraktion  
(SIFT, SURF, LBP, HOG, etc.)

(0.2, 0.4, ...)

(0.4, 0.3, ...)

Klassifikation  
(SVM, Neuronales Netz, etc.)



Containerschiff

Tiger

...

# Praxis: Musikalien digitalisieren

N 212

Die Forelle.  
Op. 84, No. 2, Schöten.  
Für eine Singstimme mit Begleitung des Pianoforte  
comp. aut. no. N° 212

Schubert's Werk.  
FRANZ SCHUBERT.  
Urs. Facsim.

Melod.

Singstimme.

Pianoforte.



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Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra  
Swiss Confederation  
Innosuisse – Swiss Innovation Agency



Die Forelle - Franz Schubert

$\text{♩} = 80$

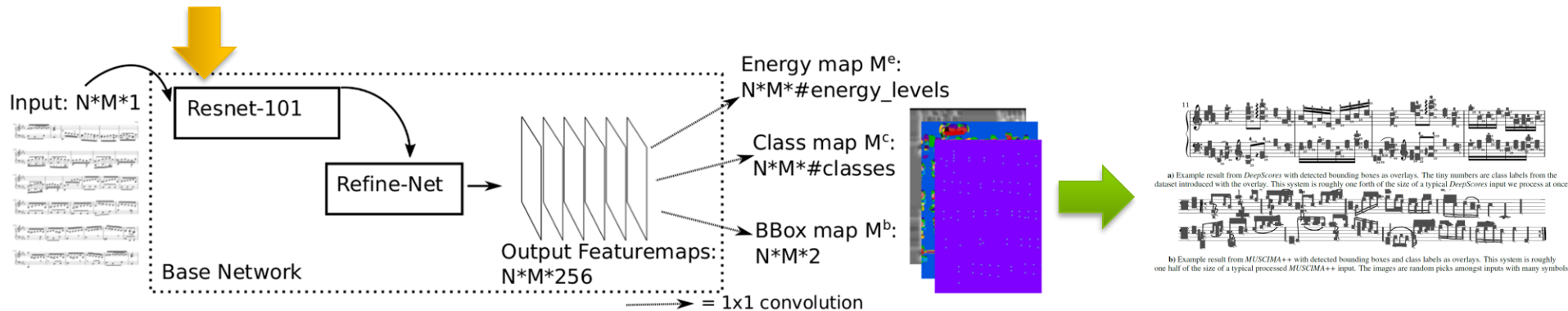
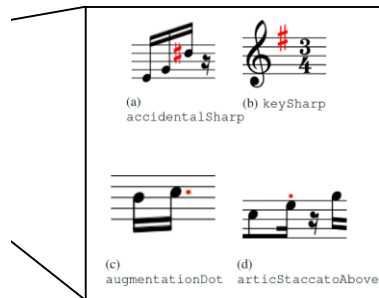
Voice

Piano

Vc.

ei - nem Büch-lein hel - le, da schoß in fro-her Eil die lau - ni - sche Fo - re - le vor -

# Herausforderungen und Lösungsansätze



Tuggener, Elezi, Schmidhuber, Pelillo & Stadelmann (2018). «DeepScores – A Dataset for Segmentation, Detection and Classification of Tiny Objects». ICPR'2018.  
Tuggener, Elezi, Schmidhuber & Stadelmann (2018). «Deep Watershed Detector for Music Object Recognition». ISMIR'2018.

# Schlussfolgerungen

- Deep Learning hat zu Paradigmenwechsel in *Mustererkennungsaufgaben* geführt
- Die Zeit vom Grundlagenresultat zur praktischer Anwendung beträgt wenige Monate
- Spezifische Aufgaben lassen sich sehr gut automatisieren (z.B. Ähnlichkeitssuche)
- KMU sind gut positioniert: schon wenige Ressourcen können grossen Unterschied machen



## Zu mir:

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- Twitter: @thilo\_on\_data
- LinkedIn: thilo-stadelmann



## Mehr zum Thema:

- Data+Service Alliance: [www.data-service-alliance.ch](http://www.data-service-alliance.ch)
- KI: <https://sgaico.swissinformatics.org/>
- Zusammenarbeit: [datalab@zhaw.ch](mailto:datalab@zhaw.ch)





# ANHANG

# Was ist passiert?

## Der ImageNet Wettbewerb



1000 Kategorien  
1 Mio. Beispiele



### 2015: Computer *haben* "Sehen" gelernt

4.95% Microsoft (06. Februar)  
→ Besser als Menschen (5.10%)

4.80% Google (11. Februar)

4.58% Baidu (11. Mai)

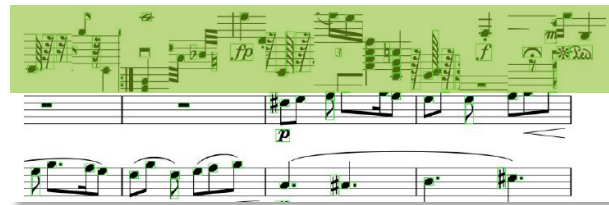
3.57% Microsoft (10. Dezember)

A. Krizhevsky verwendet als erster ein sog. «Deep Neural Network» (CNN)

# Industrialisierung der Notenerkennung

Recent results on **class imbalance** and **robustness** challenges

1. Added sophisticated **data augmentation** in every page's margins



2. Put additional effort (and compute) into hyperparameter **tuning** and **longer training**
3. Trained also on scanned (more **real-worldish**) scores



→ **Improved** our **mAP** from 16% (on purely synthetic data) **to 73%** on more challenging real-world data set (additionally, using Pacha et al.'s evaluation method as a 2<sup>nd</sup> benchmark: from 24.8% to 47.5%)

Elezi, Tuggener, Pelillo & Stadelmann (2018). «DeepScores and Deep Watershed Detection: current state and open issues». WoRMS @ ISMIR'2018.

Pacha, Hajic, Calvo-Zaragoza (2018). «A Baseline for General Music Object Detection with Deep Learning». Appl. Sci. 2018, 8, 1488, MDPI.

# Ausblick: Innovation aus neuronalen Netzen?



- *Deep Learning* ist der Kern vieler erstaunlicher Anwendungen im Bereich der Automatisierung von Wahrnehmung (Synthese & Analyse)  
→ Code & Datensätze laden “**Maker**” zum Ausprobieren ein
- *Automated Deep Learning* macht in **Zukunft** vielleicht manche Anwendung einfacher
- Aktuell braucht es ein gutes Verständnis der Details der Methode, um kreativ neue Szenarien zu erdenken (Stichwort “**mTrainer**” anstatt Programmierer?)

