



UNIVERSITÄT ZU LÜBECK
INSTITUT FÜR INFORMATIONSSYSTEME



Hello Dr. Robot – KI im Gesundheitswesen

12.00-12.15	Von digitalen Patient:innendaten zum Deep-Learning-Modell: Hello Dr. Robot
12.15-12.30	Stochastische relationale KI im Gesundheitswesen
12.30-13.00	Eure Fragen



Von digitalen Patient:innendaten zum Deep-Learning-Modell: Hello Dr. Robot.

Marisa Mohr, Dr. Robert Pesch



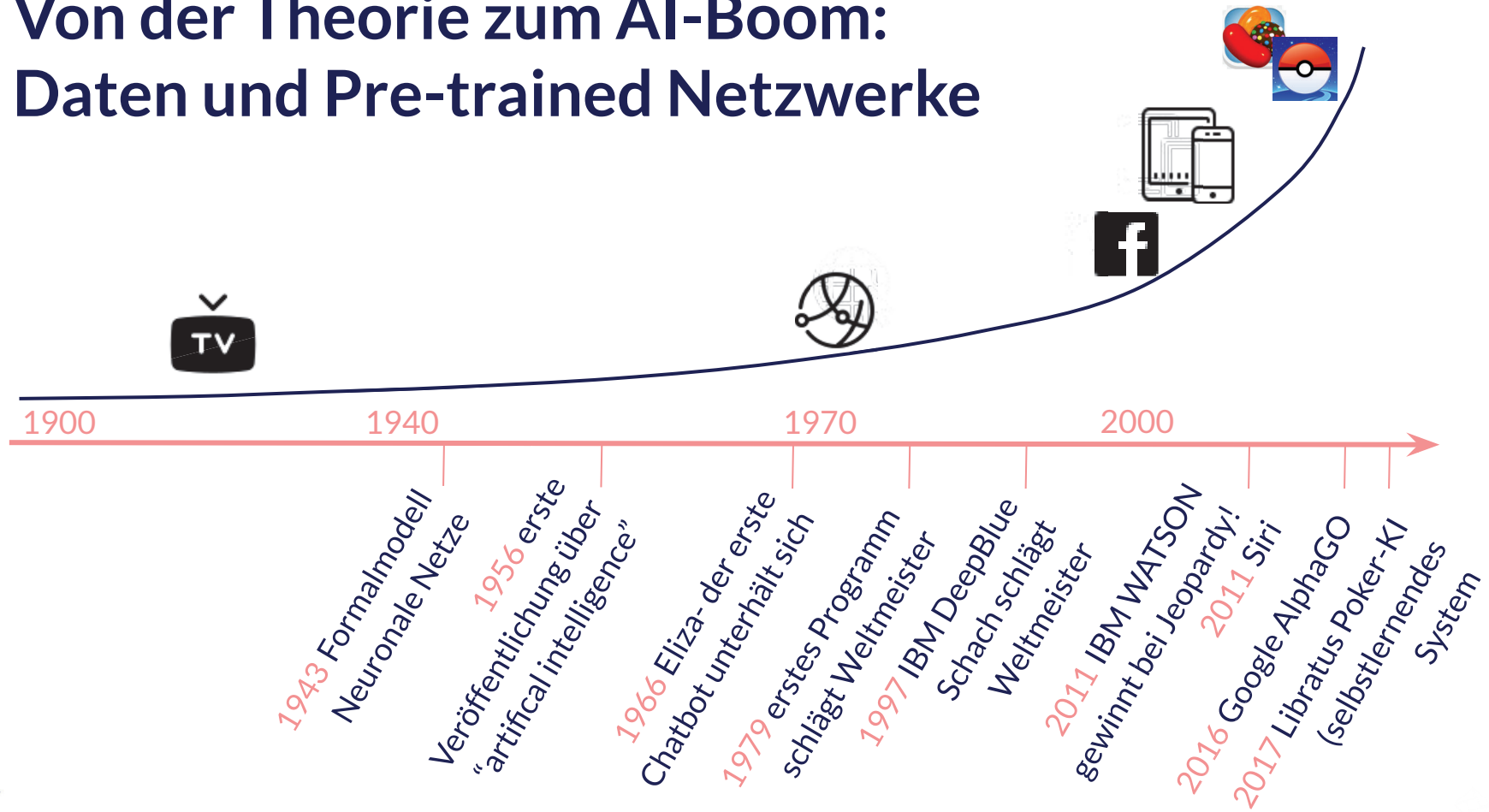
Marisa Mohr
Senior Machine Learning Engineer
M.Sc. Mathematik



Dr. Robert Pesch
Head of Data-Driven AI Solutions
M.Sc. Computer Science



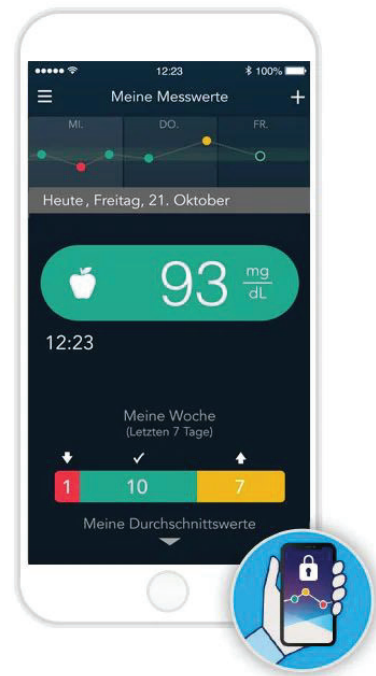
Von der Theorie zum AI-Boom: Daten und Pre-trained Netzwerke



Digitalisierung wird im Gesundheitswesen und der Medizin zunehmend ein zentrales Thema



Digitale Patientenakten und Videosprechstunden sind keine Seltenheit mehr



Hello Dr. Robot

A collection of medical data visualizations. At the top are two brain scans: an axial CT scan on the left and a sagittal MRI scan on the right. Below these is a heatmap visualization with yellow and green dots on a black background. To the right of the heatmap is a block of DNA sequence text. At the bottom are several overlapping white rectangular sheets, representing data files or reports.

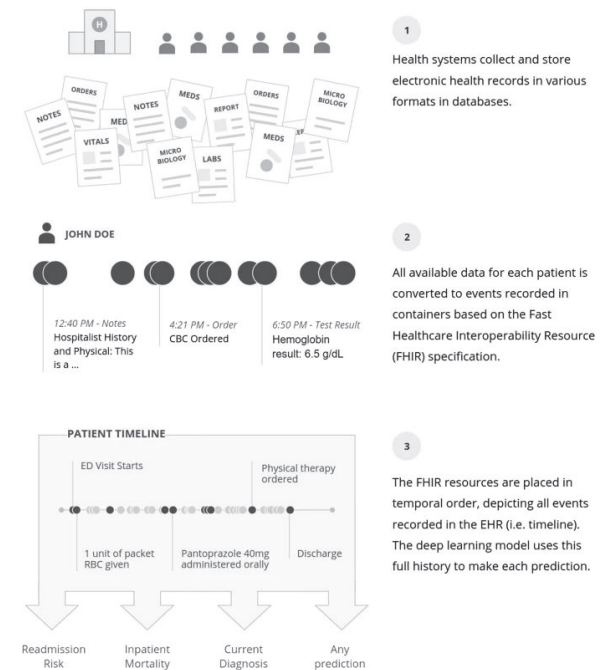
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GCCCGCTAATTCTGTTCTGTTA  
GTCGCAAGGGTCTGCTGCTGTTG  
GGCGTGTGATCGACGATCGAGGT  
TTCGGCGTAGTTGACTGGGAT  
CCTAACTAATAGTCTTAACGGGG  
TATCGCCACAGAAAGTAGGGTCT
```

Here some magic happens



Deep-Learning Modelle für Vorhersagen auf Basis von Electronic Health Records

- › Electronic Health Records sind in vielen Ländern bereits Standard
- › Die Datenmenge ist stark steigend & besteht zum größten Teil aus Freitexten
- › Vorhersagen zu z.B. Diagnose, Länge des Krankenhausaufenthalts, Sterblichkeit



Deep-Learning Modelle für Vorhersagen auf Basis von bildgebenden Verfahren

```
class MyModel(torch.nn.Module):
    def __init__(self, resnext):
        super(MyModel, self).__init__()
        self.backbone = resnext
        self.fc = nn.Conv2d(512,
                             1, kernel_size=(1, 1), stride=(1, 1), bias=True)
        self.fc_maxpool = nn.AdaptiveMaxPool2d((1, 1))
        self.dropout = nn.Dropout(p = 0.5)

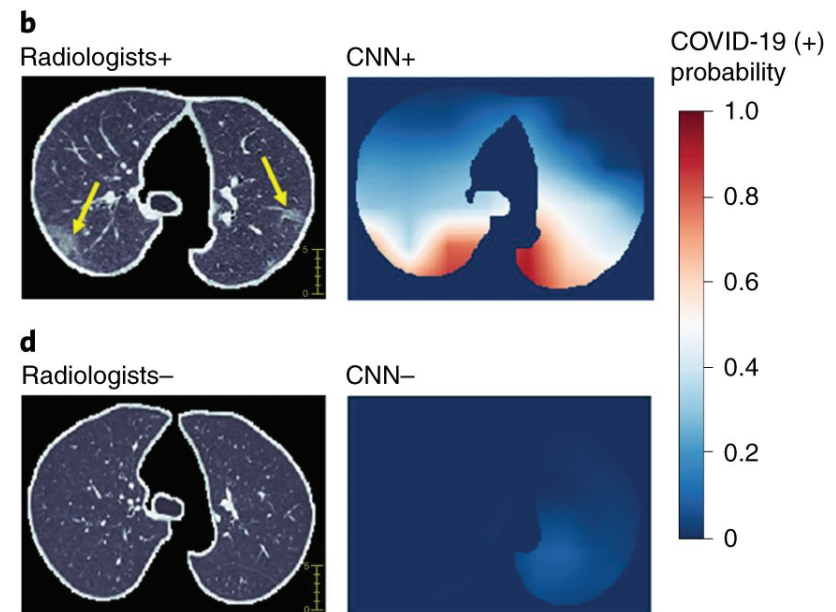
    def forward(self, x, add_noise = False, is_pooling = True):
        ## x: [batch, 1, H, W]
        x = self.pre_proc(x, add_noise = add_noise)

        x = self.backbone.conv1(x)
        x = self.backbone.bn1(x)
        x = self.backbone.relu(x)
        x = self.backbone.maxpool(x)

        x = self.backbone.layer1(x)
        x = self.backbone.layer2(x)
        x = self.backbone.layer3(x)
        x = self.backbone.layer4(x)
        x = self.dropout(x)
        x = self.fc(x)

        if is_pooling:
            x = self.fc_maxpool(x)
            x = torch.flatten(x, 1)

        return x
```

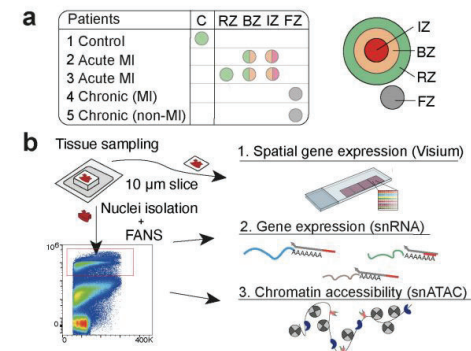
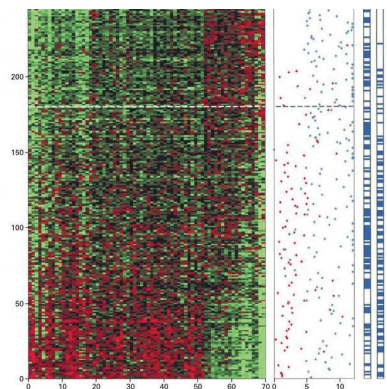
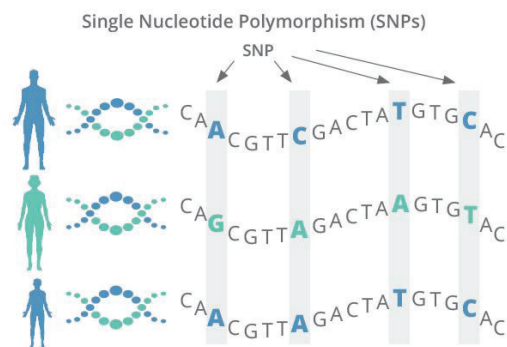


Modelle für Vorhersagen auf Basis von genomischen Daten

Identifikation von krankheitsrelevanten Genomveränderungen

Gene-Expressions Profiling für Therapievorschläge

Kombination verschiedener Datenquellen



Many More ...

LETTER

doi:10.1038/nature21056

Dermatologist-level classification of skin cancer with deep neural networks

Andre Esteva^{1*}, Brett Kuprel^{1*}, Roberto A. Novoa^{2,3}, Justin Ko², Susan M. Swetter^{2,4}, Helen M. Blau⁵ & Sebastian Thrun⁶

Article | Published: 01 January 2020

International evaluation of an AI system for breast cancer screening

Scott Mayer McKinney , Marcin Sieniek, [...]Shravya Shetty 

Nature **577**, 89–94 (2020) | Cite this article

59k Accesses | 342 Citations | 3549 Altmetric | Metrics

Review Article | [Open Access](#) | Published: 08 January 2021

Deep learning-enabled medical computer vision

Andre Esteva , Katherine Chou, Serena Yeung, Nikhil Naik, Ali Madani, Ali Mottaghi, Yun Liu, Eric

Topol, Jeff Dean & Richard Socher

ARTICLE [OPEN](#)

Scalable and accurate deep learning with electronic health records

Alvin Rajkomar ^{1,2}, Eyal Oren¹, Kai Chen¹, Andrew M. Dai¹, Nissan Hajaj¹, Michaela Hardt¹, Peter J. Liu¹, Xiaobing Liu¹, Jake Marcus¹, Mimi Sun¹, Patrik Sundberg¹, Hector Yee¹, Kun Zhang¹, Yi Zhang¹, Gerardo Flores¹, Gavin E. Duggan¹, Jamie Irvine¹, Quoc Le¹, Kurt Litsch¹, Alexander Mossin¹, Justin Tansuwan¹, De Wang¹, James Wexler¹, Jimbo Wilson¹, Dana Ludwig², Samuel L. Volchenboum³, Katherine Chou¹, Michael Pearson¹, Srinivasan Madabushi¹, Nigam H. Shah⁴, Atul J. Butte², Michael D. Howell¹, Claire Cui¹, Greg S. Corrado¹ and Jeffrey Dean¹

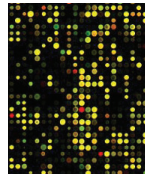
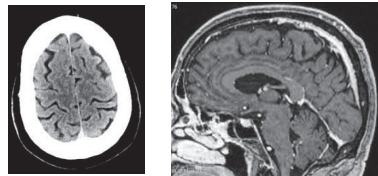
Article | [Open Access](#) | Published: 09 December 2020

Deep learning reveals 3D atherosclerotic plaque distribution and composition

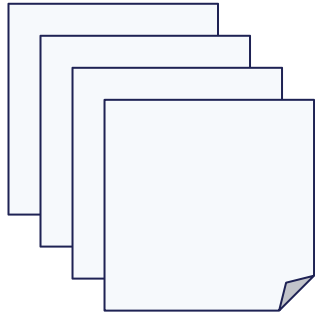
Vanessa Isabell Jurtz , Grethe Skovbjerg, Casper Gravesen Salinas, Urmas Roostalu, Louise Pedersen, Jacob Hecksher-Sørensen, Bidida Rolin, Michael Nyberg, Martijn van de Bunt & Camilla Ingvorsen 

Scientific Reports **10**, Article number: 21523 (2020) | Cite this article

Hello Dr. Robot



```
GTCCGGACAACCAGAATTGCTT  
CTTFACTGATGCATACCGCTTGG  
TGAAGTTACAGACTTCGATTA  
GACGTGCAAGGACTCAAGGGAAT  
AATTCAACTAGTGGTTTCGGCTT  
GTGTTCTATGATAAGTCTGCTT  
GGCCCGCTAATTCTGTTCTGTTA  
GTCCGAGGGTCTGCTGCTGTTG  
GGCGTGTGATCGACGATCGAGGT  
TTCGGCGTAGTGGACTGGAT  
CCTAACTAATAGTCTTAACGGGG  
TATCGCCACAGAAAGTAGGGTCT
```



Brave New World?

- › Nicht reproduzierbare und generalisierbare Ergebnisse
- › Metriken vs. klinische Anwendbarkeit
- › Interaktion zwischen Mensch und Algorithmus
- › Patientendatenschutz

OPINION

Open Access

Key challenges for delivering clinical impact with artificial intelligence



Christopher J. Kelly^{1*}, Alan Karthikesalingam¹, Mustafa Suleyman², Greg Corrado³ and Dominic King¹

Analysis | [Open Access](#) | Published: 15 March 2021

Common pitfalls and recommendations for using machine learning to detect and prognosticate for COVID-19 using chest radiographs and CT scans

Michael Roberts , Derek Driggs, Matthew Thorpe, Julian Gilbey, Michael Yeung, Stephan Ursprung, Angelica I. Aviles-Rivero, Christian Etmann, Cathal McCague, Lucian Beer, Jonathan R. Weir-McCall, Zhongzhao Teng, Effrossyni Gkrania-Klotsas, AIX-COVNET, James H. F. Rudd, Evis Sala & Carola-Bibiane Schönlieb

Nature Machine Intelligence **3**, 199–217 (2021) | [Cite this article](#)



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um unsere Kunden glücklich zu machen.
Und uns selbst.