Neuronale Netze in der Computergrafik

Darstellung und Erstellung von Virtuellen Welten

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20. JUNI 2017

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Gliederung

- Motivation
- Anwendungsbereich
- Aktuelle Arbeiten
- Meine Vorgehensweise
- Konferenzen

Motivation

Motivation

- Generelles Interesse an der Computergrafik
  - Ständig im Wandel
- Die Erforschung neuer Ansätze der Arbeit mit den Virtuellen Welten

Anwendungsbereich

Anwendungsbereich

- Echtzeit Computergrafik
- Die Erschaffung einer Virtuellen Welt

Anwendungsbereich

- Echtzeit Computergrafik

Quelle: [7]

Quelle: [9]

Quelle: [8]

Anwendungsbereich

- Die Erschaffung einer Virtuellen Welt

Quelle: [10]

Quelle: [11]

NO MAN'S SKY

Quelle: [12]

Anwendungsbereich

- Wozu dann die Neuronale Netze?
  - Die Leistungsanforderungen steigen.
  - Die Arbeit an den Virtuellen Welten wird immer komplexer.

Quelle: [13]

Quelle: [15]

Quelle: [14]

Aktuelle Arbeiten

- Procedural Content Generation via Machine Learning (PCGML)[Summerville, 2017]
- Procedural Modeling Using Autoencoder Networks [Yumer, 2015]
- Accelerating Eulerian Fluid Simulation With Convolutional Networks [Tompson, 2017]

Procedural Content Generation via Machine Learning (PCGML)

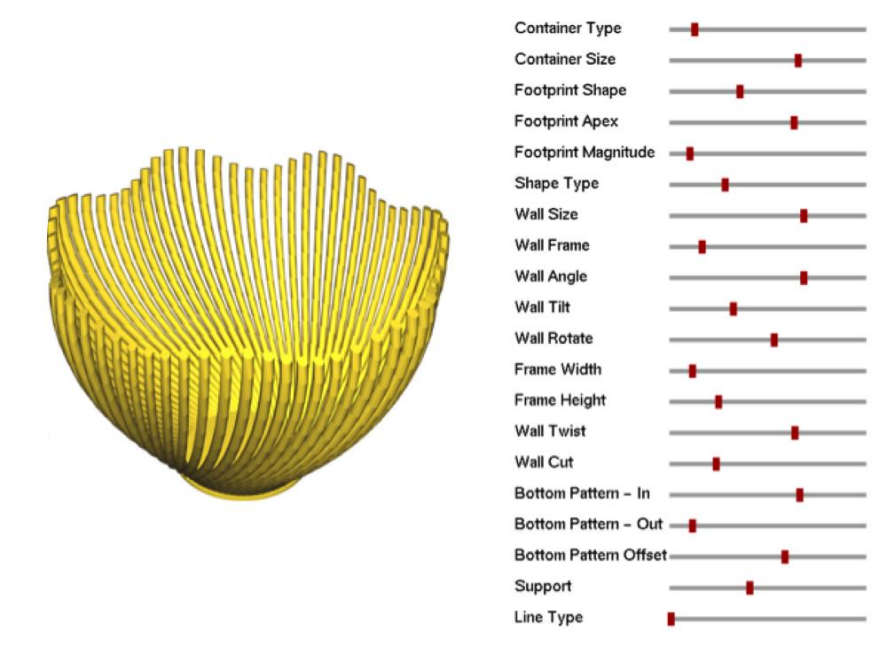
- USE CASES FOR PCGML
  - Autonomous Generation
  - Co-creative and Mixed-initiative Design
  - Repair
  - Recognition, Critique, and Analysis
  - Data Compression

Procedural Content Generation via Machine Learning (PCGML)

- OPEN PROBLEMS AND OUTLOOK
  - Learning from Small Datasets
  - Learning on Different Levels of Abstraction
  - Datasets and Benchmarks
  - Style Transfer
  - Using PCGML as a Game Mechanic

Procedural Modeling Using Autoencoder Networks

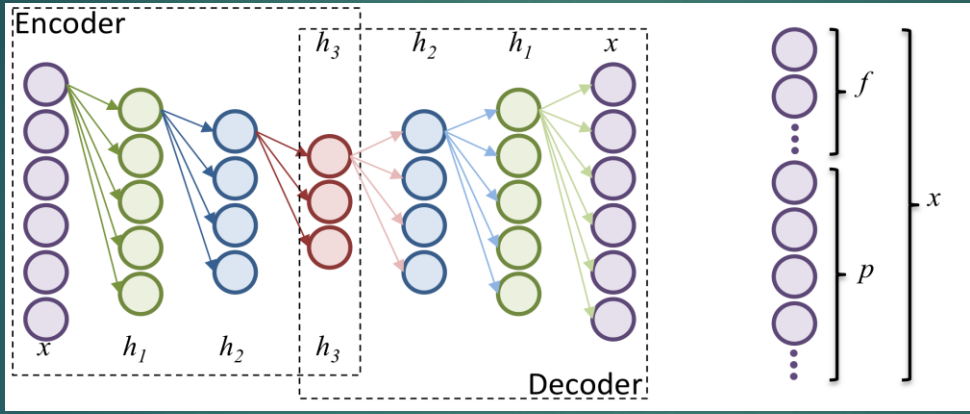
- Die Manipulation der 3D-Modelle soll einfacher werden.



Quelle: [2]

Procedural Modeling Using Autoencoder Networks

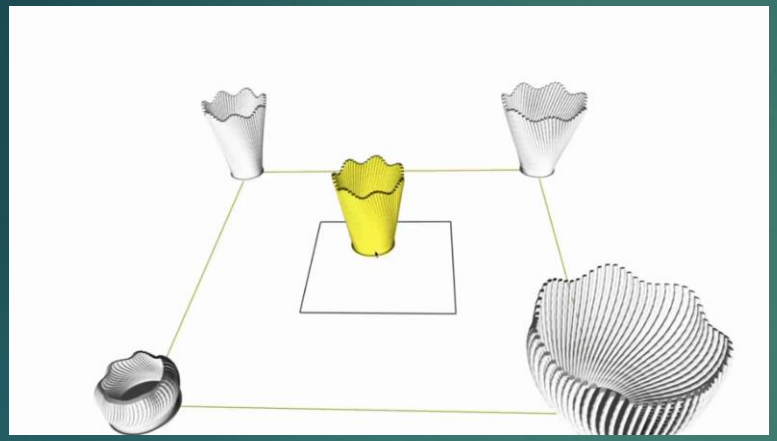
- Autoencoder Networks



Quelle: [2]

Procedural Modeling Using Autoencoder Networks

- Vergleich zwischen den Systemen



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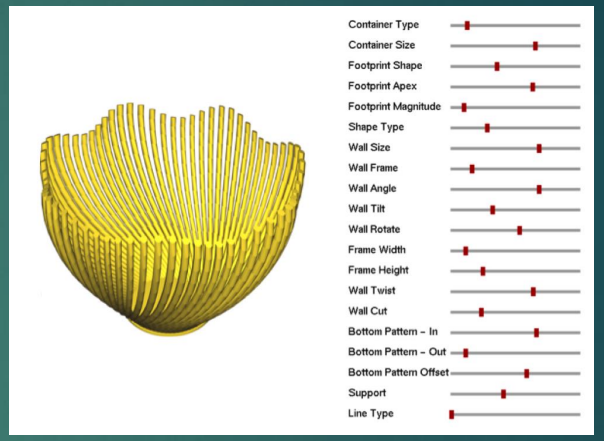

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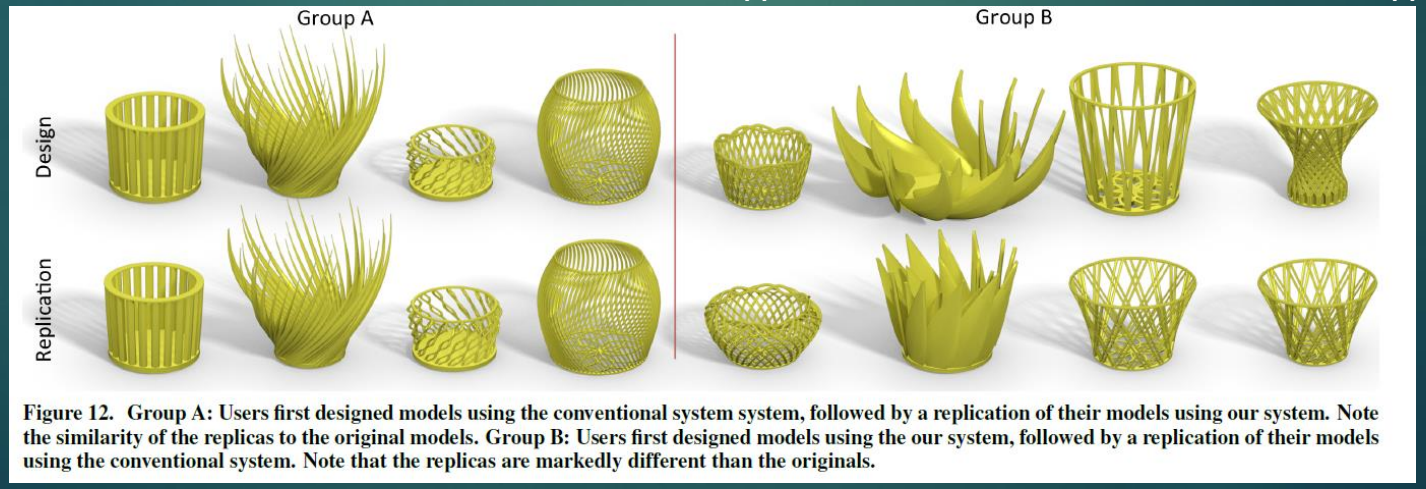


Figure 12. Group A: Users first designed models using the conventional system system, followed by a replication of their models using our system. Note the similarity of the replicas to the original models. Group B: Users first designed models using the our system, followed by a replication of their models using the conventional system. Note that the replicas are markedly different than the originals.

Quelle: [2]

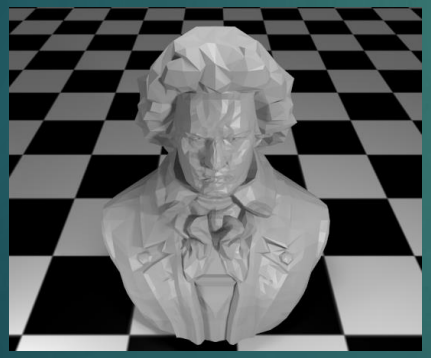
Accelerating Eulerian Fluid Simulation With Convolutional Networks

- Flüssigkeitssimulation
  - Rauch als Beispiel

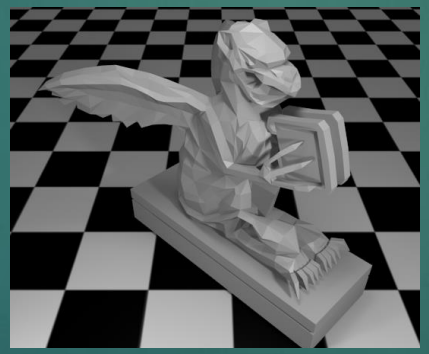
Quelle: [3]

Accelerating Eulerian Fluid Simulation With Convolutional Networks

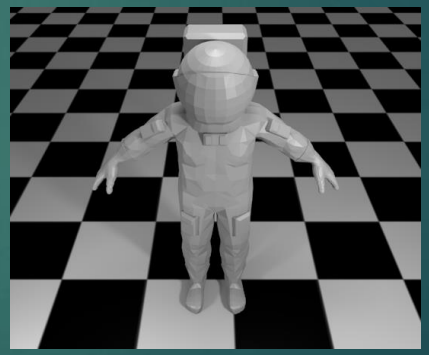
- Trainingsdaten
  - Keine echten Daten
  - Manta
- 3D-Modelle



Quelle: [3]



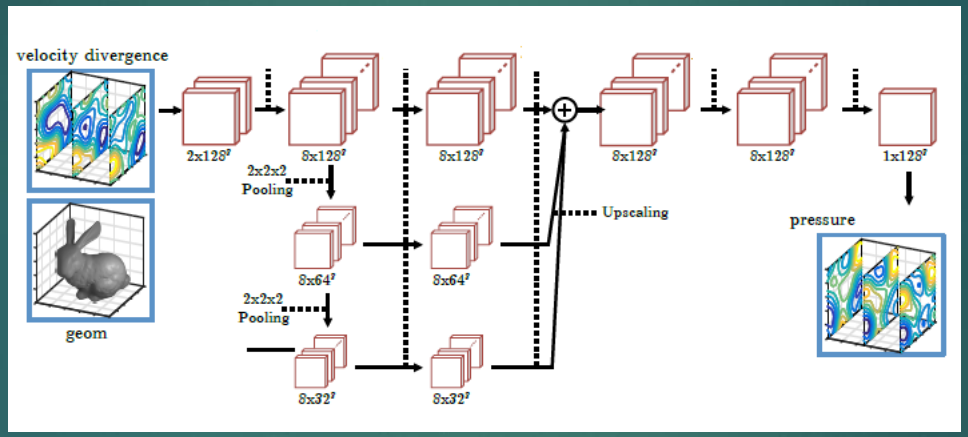
Quelle: [3]



Quelle: [3]

Accelerating Eulerian Fluid Simulation With Convolutional Networks

- Neuronales Netzwerk



Quelle: [3]

Accelerating Eulerian Fluid Simulation With Convolutional Networks

- Vergleich

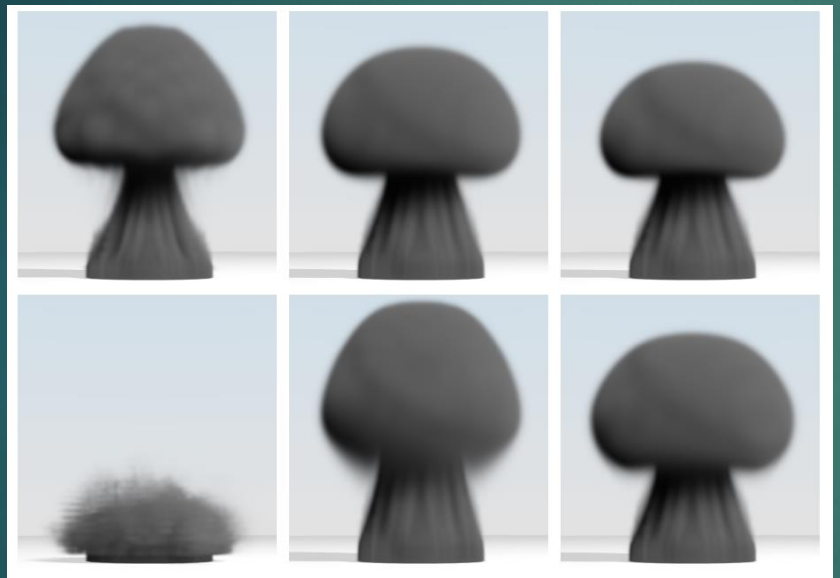
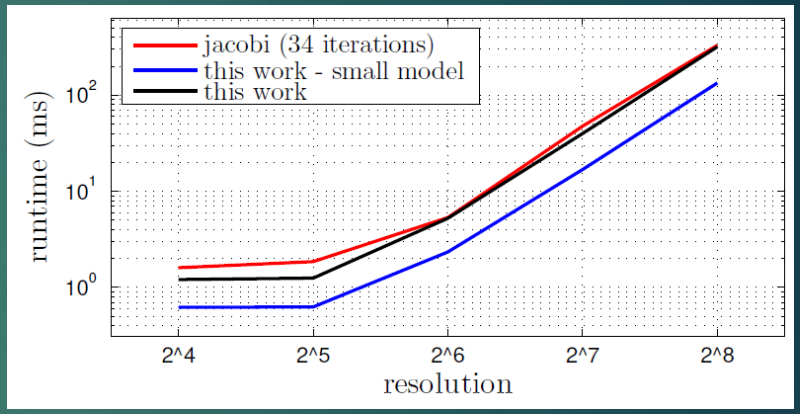


Fig. 7: Plume simulation (without vorticity confinement). *Top left*: Jacobi (34 iterations). *Top Middle* Jacobi (100 iterations). *Top Right*: PCG. *Bottom left*: Yang et al. *Bottom middle*: small-model. *Bottom Right*: this work.

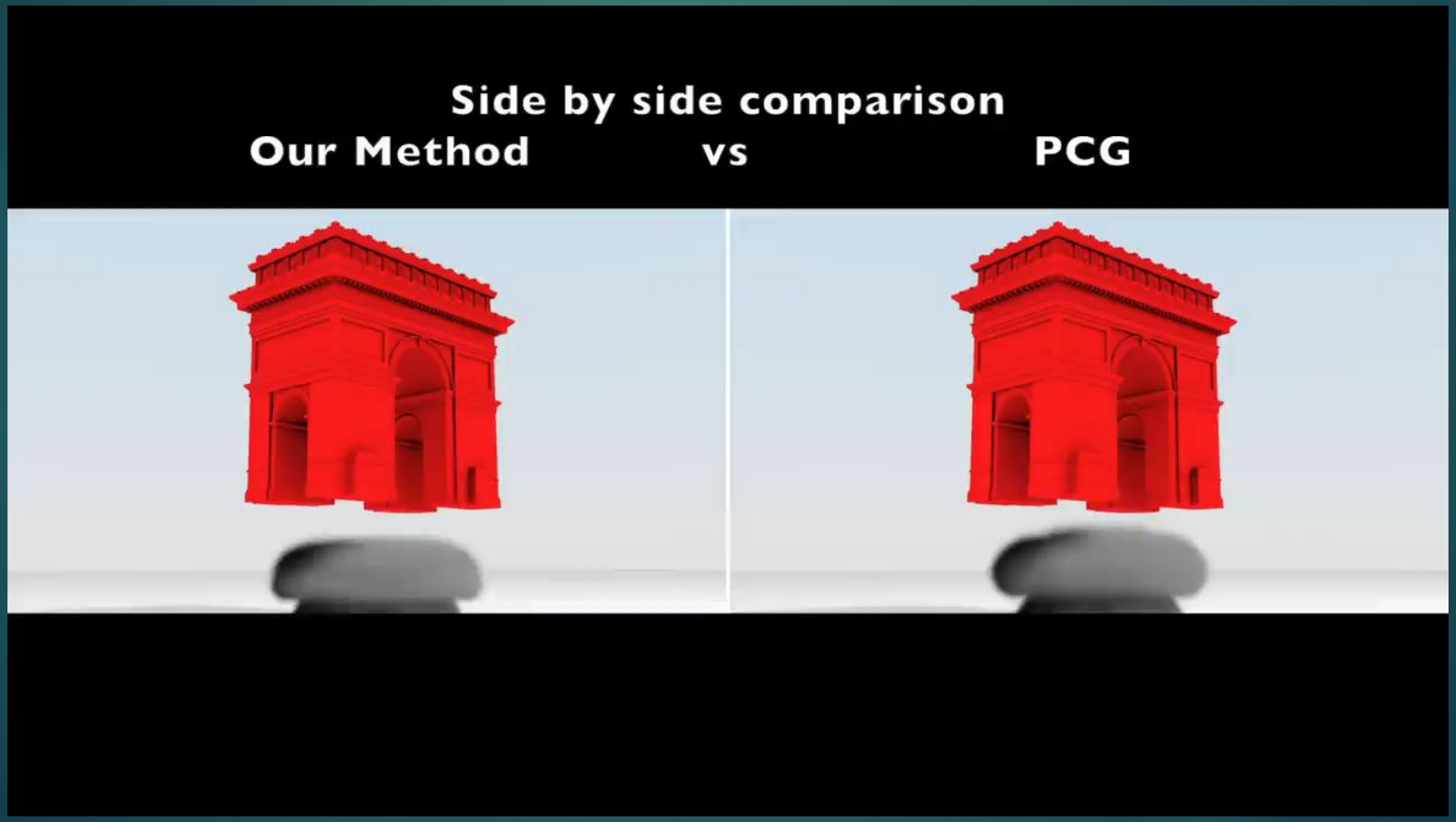
Quelle: [3]



Quelle: [3]

Accelerating Eulerian Fluid Simulation With Convolutional Networks

- Vergleich



Quelle: [3]

Meine Vorgehensweise

- Mein Verständnis von Neuronalen Netzen vertiefen.
- Kenntnisse in Mathe und Physik vertiefen.
- Praktische Beispiele ausprobieren.
- Entscheidung zwischen Simulation und Content Generation treffen.
- Masterarbeit

Konferenzen

- Computer Graphics International (CGI) 27. – 30. Juni in Yokohama, Japan
- New Trends in Image Restoration and Enhancement (NTIRE) 21. Juli in Honolulu, Hawai

Quellen

1. Summerville, Adam, et al. "Procedural Content Generation via Machine Learning (PCGML)." *arXiv preprint arXiv:1702.00539* (2017).
2. Yumer, Mehmet Ersin, et al. "Procedural modeling using autoencoder networks." *Proceedings of the 28th Annual ACM Symposium on User Interface Software & Technology*. ACM, 2015.
3. Tompson, Jonathan, et al. "Accelerating Eulerian Fluid Simulation With Convolutional Networks." *arXiv preprint arXiv:1607.03597* (2016).
4. Weston, Ben. "A Marker ans Cell Solution of the Incompressible Navier-Stokes Equations for Free Surface Flow.„ Numerical Analysis Report (6/2000)
5. Brock, Andrew, et al. "Context-Aware Content Generation for Virtual Environments." *ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. American Society of Mechanical Engineers, 2016.
6. Petrillo, Fábio, et al. "What went wrong? A survey of problems in game development." *Computers in Entertainment (CIE)* 7.1 (2009): 13.

Bildquellen

7. Wikipedia, https://de.wikipedia.org/w/index.php?title=Datei:Havoklogo.svg&filetimestamp=20110913170103&, Aufruf: 19.6.2017
8. Epic Games, https://cdn1.unrealengine.com/UnrealEngine/3506073/UE_Logo_Black_Centered_Filled-fcb16e04e0e6306235adcca98e4064aa.png, Aufruf: 18.6.2017
9. Unity Technologies, https://unity3d.com/de/public-relations/brand, Aufruf: 18.6.2017
10. Blender Foundation, https://www.blender.org/about/logo/, Aufruf: 18.6.2017
11. Blizzard Entertainment, https://bneteu-a.akamaihd.net/shop/static/images/browse/logo-small-screen-family-diablo-d9cea07ca8.png, Aufruf: 18.6.2017
12. Hello Games, https://de.wikipedia.org/wiki/Datei:No_Man%E2%80%99s_Sky_%E2%80%93_Text_logo.svg, Aufruf: 18.6.2017
13. Mobile Nations, https://www.windowscentral.com/sites/wpcentral.com/files/styles/larger/public/field/image/2016/08/no-mans-sky-space_0.jpg?itok=FE0yGNRw, Aufruf: 18.6.2017
14. http://o.aolcdn.com/hss/storage/midas/7b7bf4d6fedad87a02915e1ab0e61861/204036531/VR_Web_Product_HMD.png, Aufruf: 18.6.2017
15. Sony Interactive Entertainment, https://media.playstation.com/is/image/SCEA/playstation-4-pro-vertical-product-shot-01-us-07sep16?$TwoColumn_Image$, Aufruf: 18.6.2017