

Benjamin Biggs

GENERATIVE AI | 3D RECONSTRUCTION | COMPUTER VISION

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Introduction

I am an Applied Scientist II working for **Amazon** and received my **PhD in Computer Vision and Deep Learning** from the **University of Cambridge**. My primary research interests include **Generative AI** techniques (incl. **Diffusion Models**, **NERFs** and **GANs**) as well as **3D reconstruction** methods for challenging object categories such as **animals and humans**. I have published multiple top-tier conference papers, am a frequent guest speaker at academic and industrial institutions, have extensive experience supervising staff and have consulted for numerous companies and startups. I hold an **O1 VISA for Extraordinary Ability**. My key research highlights are available at www.benbiggs.co.uk.

Selected Publications and Patents

3D Multi-bodies: Fitting Sets of Plausible 3D Human Models to Ambiguous

Image Data

NeurIPS 2020, Spotlight (Top 3%)

BENJAMIN BIGGS, SEB EHRHADT, HANBYUL JOO, BEN GRAHAM, ANDREA VEDALDI, DAVID NOVOTNY

- We obtain a set of plausible 3D human reconstructions from monocular, partial & challenging views. This is achieved by training a multi-hypothesis neural network with a best-of-M loss, and constrain reconstructions to the manifold of plausible human poses.
- We add flexibility to the best-of-M framework using a novel quantization scheme, based on normalizing flows.

Who Left the Dogs Out? 3D Animal Reconstruction with Expectation

Maximization in the Loop

ECCV 2020

BENJAMIN BIGGS, OLIVER BOYNE, JAMES CHARLES, ANDREW FITZGIBBON, ROBERTO CIPOLLA

- Weakly supervised, automatic end-to-end system to recover 3D shape and pose for diverse dog breeds. We invent **SMBLD**: a new 3D deformable dog model with scaling parameters and a detailed shape prior refined with expectation maximization. We also release **StanfordExtra**, the largest dataset of 2D keypoint and segmentations for an animal category which has been **downloaded >1000 times**.

All Creatures Great and SMAL: Recovering the Shape and Motion of Animals

from Video

ACCV 2018, Oral (Top 5%)

BENJAMIN BIGGS, THOMAS RODDICK, ANDREW FITZGIBBON, ROBERTO CIPOLLA

- First automatic system to reconstruct 3D shape and pose for variety of animals. Trained with synthetic data to overcome need for large mo-cap/keypoint datasets.

Shape of You: 3D Shape Estimations for Diverse Body Types

CVPR-W 2023, Oral

ROHAN SARKAR, ACHAL DAVE, GERARD MEDIONI, **BENJAMIN BIGGS**

- As intern supervisor, led project based on inventing two loss functions and a test-time optimization routine that improve 3D human reconstruction accuracy for diverse body shapes.

On the Road to Large-Scale 3D Monocular Scene Reconstruction using Deep

Implicit Functions

ICCV-W 2021

THOMAS RODDICK, **BENJAMIN BIGGS**, DANIEL OLMEDA REINO, ROBERTO CIPOLLA

- We extend deep implicit functions to large-scale driving scenes. To avoid requiring watertight meshes for training, we instead use LiDAR to approximate ground truth occupancy labels.

A Clothing Compliance Detection Apparatus and Associated Clothing Standard

Enforcement Apparatus

WO/2018/109048

BENJAMIN BIGGS AND PATRICK HYETT

- Patent related to a computer vision solution for verifying that lab personnel are wearing protective clothing.

Education

PhD in Computer Vision and Machine Learning

The University of Cambridge

2017 - 2021

- Supervised by **Andrew Fitzgibbon** and **Roberto Cipolla**, I developed methods to reconstruct complex geometries such as humans and animals in 3D. I also developed various activity/behaviour tracking systems to monitor animals. Thesis available at: www.benbiggs.co.uk.
- Represented GSK/Microsoft at various events, notably the *BMVC 2017* and the *Summer Science Fair* at the Royal Society, London.

BSc in Discrete Mathematics

The University of Warwick

2012 - 2016

- **First Class Honours (81.4% including 83.6% final-year average)**.
- **Awarded:** *Best Overall Graduating BSc student in Discrete Mathematics*, *Best 3rd Year Project Prize* and *Best Information Structures Coursework*.
- **Modules include:** **Image and Video Analysis**, **Machine Learning**, **Artificial Intelligence**, Combinatorial Optimization, Advanced Algorithms, Complexity of Algorithms, Algorithmic Graph Theory, Algorithmic Game Theory, Advanced Linear Algebra and Algebra 2: Groups and Rings.

Industrial Experience

Applied Scientist II

Amazon, San Francisco

Oct. 2021 - Present

- Significant experience developing **Generative AI techniques** for **conditional image/video synthesis**, including virtual try-on and text-to-image applications. My work has significant internal exposure and I regularly present in **VP-level review meetings**.
- I have also delivered projects on **3D shape estimation** and **selfie-based fashion recommendation** for Amazon Style, a physical fashion store I helped launch in May 2022. I have filed patents, supervised PhD interns, interviewed candidates and represented Amazon at conferences.

AI Research Intern

Facebook AI Research, London

Jun. 2019 - Nov. 2019

- Supervised by **Andrea Vedaldi**, I worked on an end-to-end deep learning system for reconstructing humans in 3D from ambiguous/challenging monocular images. I collaborated in a global research team, delivered multiple technical presentations and achieved a contract extension.
- **Publication:** Submitted paper achieved a **Spotlight at NeurIPS 2020** and I gave a live presentation at the conference.

AI Research Consultant

GlaxoSmithKline, Stevenage

Jan. 2017 - Oct. 2021

- Machine learning consultant, working as a **leadership team** member for a fast-paced innovation group at **GlaxoSmithKline**. Led & contributed to multiple projects, including: action recognition, machine setting optimization, and defect detection. Interviewed & supervised staff.
- **Awarded:** Two of my students achieved *Best Final Year Project* awards at their respective universities.

Computer Vision Researcher

GlaxoSmithKline, Stevenage

Jun. 2014 - Jan. 2017

- Completed the **full development life cycle** of technical projects, including eliciting requirements, application development, system testing and eventual knowledge transfer into support. Represented GSK in meetings with external vendors and aided in key procurement decisions.
- Liaised with legal team to file a **patent** and demonstrated work to executive staff, incl. **Emma Walmsley (CEO)** and **Sir Andrew Witty (ex-CEO)**.
- **Awarded:** *Recognition of Excellence* for leading an outstanding project at GSK.

Technical Skills

Deep Learning and Optimization

- Proficient in designing and training **neural networks** to solve computer vision and data science problems, using **PyTorch** and **TensorFlow**.
- Extensive experience developing **Generative AI architectures**, incl. **Diffusion Models**, **NERFs**, **GANs**, **VAEs/AEs** and mixture density networks.
- Highly proficient in **3D reconstruction**, particularly for **humans and animals**. Well versed in techniques using morphable models (e.g. **SMPL/SMAL**) and model-free methods (e.g. using **implicit functions**). Confident with multiple view geometry.
- Significant experience working with **text-based transformer architectures** (e.g. BERT, GPT), zero-shot learning and recommendation systems.
- Highly proficient with approaches for object detection, 2D/3D keypoint estimation, segmentation and classification.

Programming Languages

- Highly proficient in **Python** (incl. Cython experience) and **C# .NET** (incl. WPF and Office Add-Ins).
- Good working knowledge of **C++/C**, **MATLAB**, **Java**, **JavaScript** and **PHP / HTML 5.0**. Also confident with **LaTeX** markup language.
- Some experience editing and compiling **CUDA** libraries and Haskell development.

Software Development

- Familiar with common design patterns and language features (incl. object orientation, advanced data structures, generics, async routines).
- Extensive experience in **Unix (Ubuntu, RedHat and Fedora)** and Windows operating systems.
- Experience with **Git / TFS** source control, **HPC environments** (incl. SLURM), **Agile methodologies** (incl. test driven development), database technologies (incl. Blockchain, Microsoft SQL Server and Oracle) and mobile app development.

Teaching and Presentations

- Experience **mentoring & supervising**, including PhD interns and multiple students at master's and undergraduate stage. I have run various tutorials and seminars in academic and industrial contexts.
- Wealth of **presentation experience**, incl. **NeurIPS 2020/ACCV 2018** conference orals, technical presentations incl. **Epic Games** [San Francisco, US], **UC Berkeley** [San Francisco, US], **National Institute of Health** [North Carolina, US]. Numerous live demos to executive stakeholders.
- Experience engaging young students in STEM, incl. representing Microsoft at the Summer Science fair at **The Royal Society, London**.

Other

- **O1 VISA Holder** – right to work in USA granted for Exceptional Ability.
- USA and UK Driver's License Holder.

Extracurricular Activities

I am a passionate musician and achieved **Grade 8 Piano with Distinction** aged 16. Since then, I have performed and directed many musical theatre shows, including *Sweeney Todd* which played to an audience of over two thousand. I continue to perform as a singer-songwriter at various engagements, including weddings. I am passionate about bringing technology and music to young or disadvantaged members of our communities; I have represented Microsoft at STEM outreach events and assisted in a care home.

References

References from supervisors and past employers are available on request.