Chengshuai (Abraham) Yang, Ph.D.

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RESEARCH SUMMARY

I am a machine learning and computational imaging researcher working at the interface of **statistical learning theory, scientific machine learning, and high-dimensional inverse problems**. My work combines probabilistic modeling, optimization, and deep learning to build **trustworthy, scalable AI systems** for complex scientific and biomedical data, including MRI/CT, optical imaging, and multi-modal health records.

Methodologically, I study **physics-informed and statistically principled learning algorithms** for inverse problems and spatiotemporal data, with an emphasis on **uncertainty quantification, robustness, and generalization** (e.g., conformal prediction, ensemble priors, plug-and-play and unrolled methods). Application-wise, I have developed models for radiology, computational imaging, and high-dimensional biomedical signals, leading to **20+ peer-reviewed publications**, including first-author work in **ECCV, IJCV, Optica, and Physical Review Letters**.

Currently, I serve as **CEO & Research Director of CompareGPT.io and NextGen PlatformAI C Corp**, where I lead the development of **"AI Scientist" systems**—multi-agent, statistically grounded AI workflows that read literature, design experiments, and run large-scale analyses. I am now seeking a tenure-track faculty position where I can build a group on the **mathematical and computational foundations of machine learning and AI for science**, while contributing to teaching in machine learning, data science, and computational imaging.

RESEARCH INTERESTS

Statistical machine learning & high-dimensional inference

Scientific machine learning and AI for science (inverse problems, PDE-constrained learning, physics-informed models)

Uncertainty quantification and distribution shift (conformal prediction, calibration, robustness)

Computational imaging & inverse problems (MRI/CT/optical) as testbeds for high-dimensional statistics

Multi-modal data integration (images, text, EHR/tabular) and causal/associational modeling in health data

Agentic "AI Scientist" systems: multi-agent, statistically principled workflows for automated discovery

EDUCATION

Postdoctoral Training — University of California, Los Angeles *Oct 2021 – Sep 2023*
Major: Machine Learning | Minor: Optical / Biomedical Imaging

Ph.D. — East China Normal University (ECNU) *Sep 2015 – Jun 2020*
Major: Optical Imaging | Minor: Machine Learning
Outstanding Ph.D. Award, **Future Scientist Development Program Fellow**

B.S. — Nantong University   *Sep 2011 – Jun 2015*
Major: Applied Physics | Minor: Computer Science

ACADEMIC POSITIONS

Research Director & CEO — CompareGPT.io and NextGen PlatformAI C Corp
Los Angeles, CA, Mar 2024 – Present
- Founded and lead a research-driven AI company building **axiom-checked, trustworthy AI agents** for scientific computing and data analysis.
- Direct research on **multi-agent "AI Scientist" systems** that couple probabilistic models, deep learning, and symbolic tools to perform end-to-end statistical workflows (data curation → modeling → uncertainty analysis → reporting).
- Initiated **early-stage collaborations**, including:
  - **Prof. David J. Brady**, Wyant College of Optical Sciences, University of Arizona — on **multi-aperture imaging**, framing fusion of multiple views as a high-dimensional statistical estimation problem with structural priors, to be embedded in the CIAS framework
  - **Biophotonics Lab, Prof. Changhuei Yang, Caltech** on **Fourier ptychographic imaging**, applying **physics-guided deep learning and statistical regularization** to phase retrieval.
- Built scalable experiment infrastructure (multi-GPU, large-scale sweeps) for evaluating algorithms under **distribution shift, noise variation, and domain adaptation**.

Postdoctoral Scholar — University of California, Los Angeles (UCLA)
Dept. of Electrical and Computer Engineering, Oct 2021 – Sep 2023
- Developed **diffusion- and GAN-based statistical models** for light-field tomography and hyperspectral imaging, emphasizing likelihood-based reconstruction, prior modeling, and sample-efficient learning.
- Proposed **unsupervised and meta-learning frameworks for inverse problems and compressed sensing**, treating reconstruction as **Bayesian inference under learned priors**.
- Managed **multi-GPU infrastructure** for large-scale experiments and implemented reproducible pipelines for hyper-parameter tuning, statistical evaluation, and ablation studies.
- Collaborated with clinicians and statisticians to design **evaluation metrics and statistical protocols** for imaging biomarkers and outcome models.

Machine Learning Optics Team Leader — Westlake University
Oct 2020 – Sep 2021
- Founded and led a machine-learning-based computational imaging group (five Ph.D. students + RAs).
- Published papers in **ECCV 2022** and **IJCV 2023** on diffusion models and plug-and-play reconstruction.
- Advanced **reinforcement learning and ensemble methods** for snapshot compressive imaging.
- Mentored graduate and Ph.D. students in algorithm development, coding practice, and manuscript preparation.

Research Assistant & Ph.D. Student — East China Normal University (ECNU)
Sep 2015 – Jun 2020
- Researched **compressed ultrafast photography**, **single-pixel imaging**, and **deep unfolding methods**.
- Collaborated on national research projects in computational optics and deep learning.
- Mentored junior graduate students in research design, coding implementation, and publication writing.

Machine Learning Engineer — Workmagic
San Francisco, CA, Oct 2023 – Mar 2024
- Led **diffusion-based generative video models** for advertising, focusing on data curation, model evaluation metrics, and error analysis.
- Built a **virtual try-on system** (segmentation + generative refinement) and evaluated performance using statistical measures of fit, robustness, and user-study feedback.
- Helped prototype an internal **GPT-4-powered product copilot**, integrating LLMs into data workflows.

RESEARCH PROJECTS

CIAS-X: Computational-Imaging AI Scientist (PlatformAI) (PI) *| 2024–present*

- Designed a multi-agent "AI Scientist" framework that integrates **forward models**, reconstruction networks, and vision transformers for automated experiment design and analysis.

- Implemented modules for **dose-aware reconstruction**, spatiotemporal modeling, and cross-modality transfer (e.g., optical $\rightarrow$ X-ray).

- Built scalable workflows that run **100–300 configuration sweeps** (mask patterns, regularization, architectures) to identify optimal imaging/reconstruction strategies, targeting deployment on HPC clusters or supercomputers.

Multi-Aperture Fusion for Gigapixel / Light-Field Imaging

Early-stage collaboration with Prof. David J. Brady, Wyant College of Optical Sciences, University of Arizona

- Initiated a project with Prof. Brady and his student **Adel Al-Ghazwi** on **multi-aperture imaging**, aiming to fuse multiple camera views into a single high-fidelity image.

- Framing the problem as a **high-dimensional statistical estimation task with structural priors**, to be implemented within the **Computational-Imaging AI Scientist (CIAS)** framework.

- Current focus: defining suitable **camera setups and datasets** from the Arizona Camera Lab and planning **CNN/transformer-based fusion architectures** targeting real-time or near-real-time performance on GPU clusters.

Fourier Ptychographic Imaging with Physics-Guided Deep Learning (Biophotonics Lab, Prof. Changhuei Yang, Caltech))

- Co-designed **Fourier ptychographic imaging pipelines** combining coded illumination, complex-field reconstruction, and deep learning priors.

- Explored **foundation-style vision models** (e.g., ViT-like architectures) to transfer knowledge across different sample types and imaging conditions.

AI-Assisted Inverse Problem Reconstruction for CT/MRI

- Integrated optimized agents (retriever, coder, evaluator) with **deep unfolding** and physics-constrained learning for CT and MRI reconstruction.

- Developed plug-and-play and unrolled optimization schemes that embed imaging physics directly into deep networks, improving robustness at low dose.

- Added **uncertainty estimation and calibration** layers to quantify reconstruction reliability under domain shifts (dose changes, scanner differences).

Light-Field and Hyperspectral Imaging (Biomedical-Oriented)

- Designed diffusion and transformer models for **noise-robust, data-efficient 3D reconstruction** in light-field and hyperspectral imaging.

- Demonstrated improved reconstruction quality for low-photon and compressed acquisition regimes, relevant to **retinal imaging and microscopy**.

Compressed Ultrafast Photography and Single-Pixel Imaging

- Developed multi-encoding and Augmented Lagrangian algorithms to enhance **temporal resolution and reconstruction fidelity** in compressed ultrafast photography.

- Explored extensions to **label-free biomedical imaging**, where high-speed dynamics and low photon budgets are critical.

SELECTED PUBLICATIONS

(Full list available on [Google Scholar](#))

1. **Chengshuai Yang**, Shiyu Zhang, Xin Yuan. *Ensemble Learning Priors Unfolding for Scalable Snapshot Compressive Sensing.* **ECCV 2022.**
2. **Zongliang Wu**, **Chengshuai Yang**, et al. *Adaptive Deep PnP Algorithm for Video Snapshot Compressive Imaging.* **IJCV 2023. (Co-first author)**
3. **Chengshuai Yang**, et al. *Hyperspectrally Compressed Ultrafast Photography.* **Physical Review Letters 124 (2020).**
4. **Chengshuai Yang**, et al. Optimizing codes for compressed ultrafast photography by the genetic algorithm. **Optica 5 (2018).**
5. Ruixuan Zhao, **Chengshuai Yang**, R. T. Smith, Liang Gao. *Label-Free Coded-Aperture Hyperspectral Fundus Camera.* **SPIE COSI/AI 2024.**

BOOKS & MONOGRAPHS

[**The Computational Imaging AI Scientist: Seeing and Steering the Hidden Universe**](#) (completed monograph, 2025).

Concept and outline for CIAS as an AI co-researcher for imaging-driven science.

[**AI Scientist: AGI, Scientific Discovery, and the Future of Human Research**](#) (completed monograph,

2025).

Develops conceptual and technical frameworks for **AI Scientist systems** that combine LLMs, tools, and statistical workflows for scientific discovery.

[**A Silicon Valley Perspective on Superintelligence and the Human Singularity**](completed monograph, 2025).

OPEN-SOURCE & COMMUNITY

1. `Agents Community Hub:` Curated registry for reusable agents (cards, tags, versions, evals); supports permissioned sharing and attribution.
2. `Starter Packs:` Templates for `system-agent stacks` (RAG-science, code-gen+tests, imaging pipelines) with tracing and audit logs.
3. `valuation Sets:` Public task sets & scripts for RAMTA-style scoring, unit tests, and reproducibility.

TEACHING & MENTORSHIP

- **Graduate Mentorship:** Supervised and co-supervised Ph.D. and Master's students at ECNU and Westlake University in computational imaging, statistical ML, and deep learning.
- **Informal Teaching (PlatformAI):** Designed and taught modules on **probability, statistics for ML, neural networks, computer vision, NLP, reinforcement learning, and agentic AI workflows**, with hands-on coding assignments.
- **Earlier Teaching:** Taught mathematics, physics, and English to pre-university students in China, building strong pedagogical and communication skills.
- Developed practical training materials for implementing **physics-guided reconstruction networks and uncertainty-aware models** in Python/PyTorch.

HONORS & AWARDS

Outstanding Ph.D., East China Normal University (2020)

Future Scientist Development Program Fellow, ECNU (2019)

Academic Innovation Promotion Award, ECNU (2018)

SKILLS

Programming Languages: Python, C/C++, MATLAB, CUDA, SQL
Frameworks & Libraries: PyTorch, TensorFlow, LangChain, Docker, AWS
Languages: English (Professional Fluency), Chinese (Native)