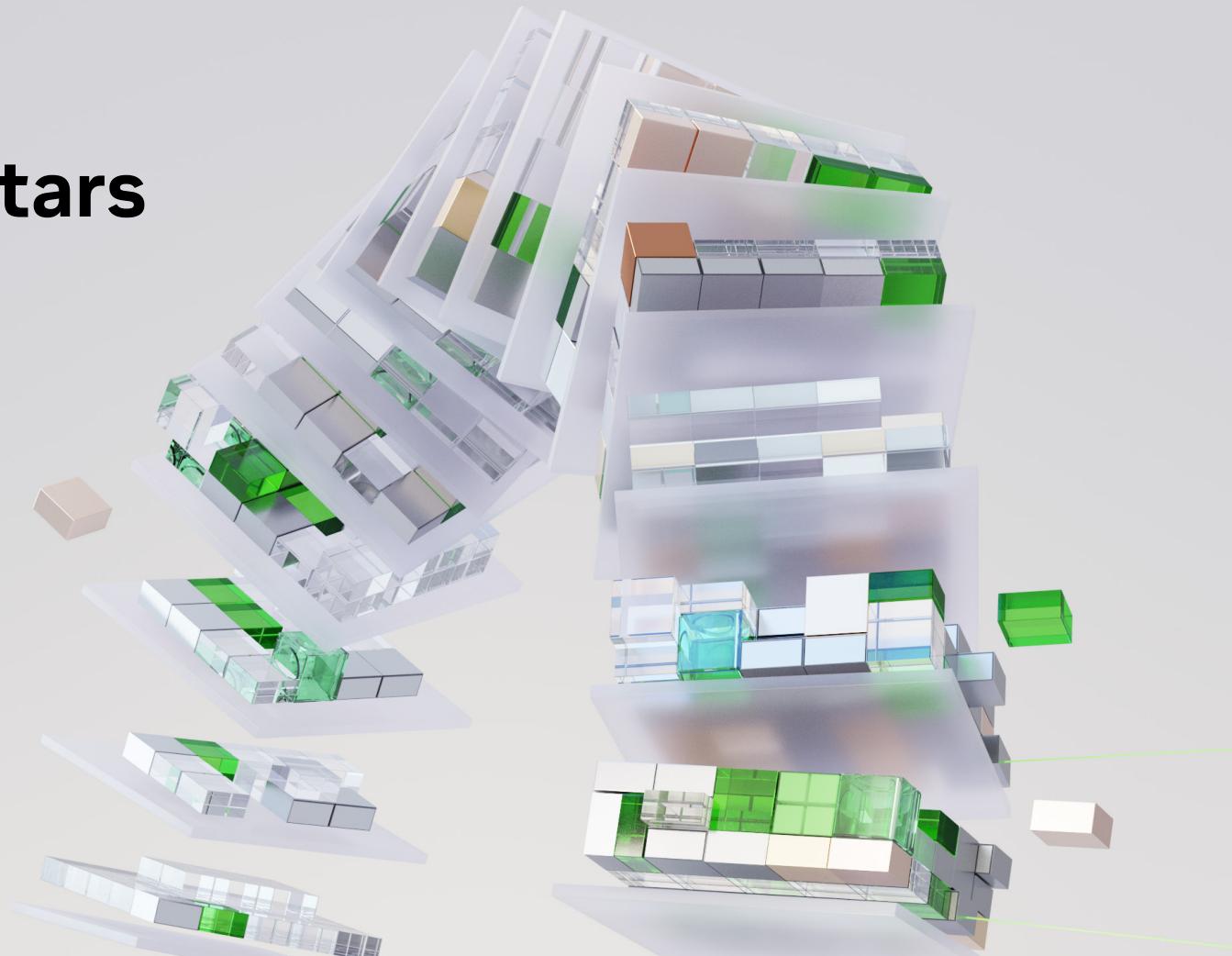


# OpenUSD All-Stars

Third Edition



# Enabling Interoperable 3D Workflows for Physical AI

**Universal Scene Description**, also known as **OpenUSD**, is an open and extensible ecosystem for describing, composing, simulating, and collaborating within 3D worlds.

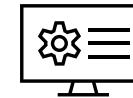
OpenUSD delivers essential features and capabilities that make it easier for teams to bring complex projects to life by connecting disparate data, tools, and workflows within a single, standardized framework. The unique features of USD are a layered composition engine, custom schemas, file-system--agnostic asset resolver, and the HYDRA rendering architecture.

At its core, OpenUSD is more than a format—it's a flexible, open foundation for the future of physical AI. NVIDIA is collaborating closely with partners and the open-source community to accelerate and expand the adoption of OpenUSD. Together with Pixar, Adobe, Apple, and Autodesk, NVIDIA formed the **Alliance for OpenUSD (AOUSD)**, which is dedicated to fostering the standardization, development, evolution, and growth of OpenUSD.



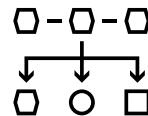
## Composition Engine

Sparse,  
non-destructive  
scene aggregation



## Custom Schemas

Extensible  
data model



## Asset Resolver and Data Abstraction

File system,  
storage, and  
serialization agnostic



## Hydra

Generalized  
pipeline for  
post-composition  
runtimes

# Athena Angara

Multidisciplinary Research Intern, AI and Robotics



“OpenUSD lets me experiment, restructure, and scale with confidence—it’s like using Lego blocks to build the future of robotics.”

Athena Angara works as a multidisciplinary research intern in AI and robotics at Argonne National Laboratory, with a background in data science from the University of Illinois Chicago. She works on integrating robotic systems, XR (AR/VR) interfaces, and AI-driven automation—bringing together immersive technologies to build safer and smarter robotic environments. Using OpenUSD, [Isaac Sim](#), and XR, Athena has helped create real-time dual-arm **robotics simulation** to model a digital twin environment for self-driving labs.

OpenUSD has proven especially helpful, allowing her to modularly structure components, support AI and XR integration, and efficiently manage iteration in a scalable way. A key feature of OpenUSD is its flexibility, which enables Athena to rapidly prototype and combine different simulation elements, treating them as building blocks rather than hardcoded systems. By shifting to this unified, real-time development pipeline, her team’s ability to test, validate, and deploy robotics logic has been significantly accelerated, allowing for safer and more effective deployment.

As a result, Athena views OpenUSD as not just a file format, but a strategic foundation for the next generation of **robotics research**, where experiments become more repeatable, adaptable, and collaborative.

Athena continues to explore how OpenUSD supports adaptive systems, smart automation, and AI training in simulation, helping to shape the future of intelligent robotics and bridge the gap between digital tools and physical innovations.

Learn more about [Athena's work](#).



# Muammer Bay

Founder and Robotics Educator



"The USDA format [of OpenUSD] bridges 3D workflows and code—making simulation assets easy to read, version, and automate—helping pave the way for next-generation AI-driven robotics."

Muammer Bay, founder of LycheeAI and recognized as an **NVIDIA Robotics** Ambassador, is a leading simulation engineer. On his educational **YouTube channel**, he empowers thousands of engineers, researchers, and robotics enthusiasts by sharing his expertise in robotics simulation and **synthetic data generation**. His interest in this field began with an academic focus on robotics and computer vision, as well as a passion for video games. He first encountered OpenUSD while researching **synthetic data** with Isaac Replicator, which sparked a lasting interest in simulation-based robotics and the value of unified digital worlds.

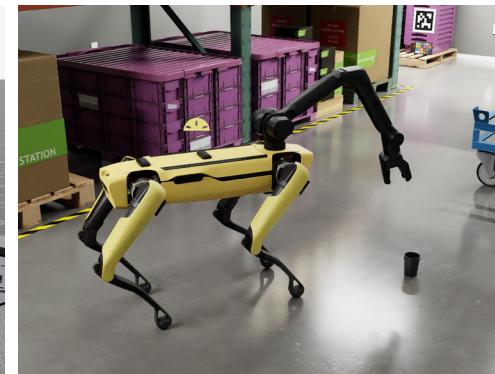
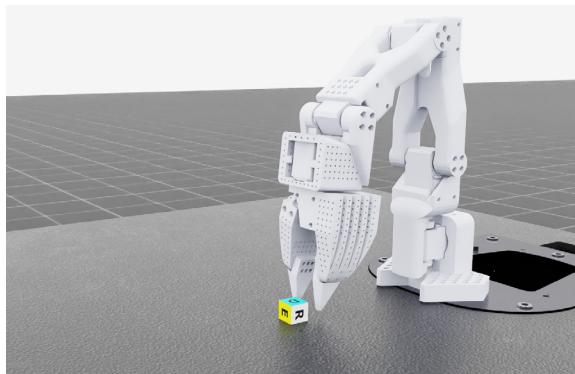
Before OpenUSD, Muammer found it challenging to combine accurate physics, real-time rendering, ROS, and Python into a single pipeline. Relying on multiple, disconnected tools led to fragmented workflows and inefficient collaboration.

Today, OpenUSD enables Muammer to rapidly build, train, and iterate AI models, swap scene elements, and focus on teaching others how to deploy these state-of-the-art approaches. For example, the **GROOT Mimic** pipeline demonstrates efficient and scalable imitation learning, utilizing OpenUSD to manage articulated environments and

**generating synthetic motion** data from human demonstrations. The modular, ASCII-readable USDA format enables clarity, version control, and seamless code integration.

As a result, Muammer can automate asset manipulation and enhance 3D creation with **generative AI**. Adopting OpenUSD allows him to rapidly build, modify, and share complex articulated environments, sensor rigs, and robotic demonstrations with ease. OpenUSD's impact reaches beyond individual productivity—it's reshaping how the robotics community collaborates, shares assets, and builds together.

Learn more about **Muammer's work**.



# Darian Hogue

Software Engineer



“OpenUSD plays a key role in helping us meet the SimReady requirements of Omniverse. By structuring assets using USD, we ensure they are properly organized, physically accurate, and compatible with the Omniverse simulation pipeline.”



Darian Hogue works as a Full-Stack Software Engineer at Mcity, a leading research initiative at the University of Michigan focused on connected and autonomous vehicle technologies. He develops robust software tools that enable researchers and industry partners to validate innovations, analyze data, and make informed decisions to improve roadway safety. During development of the open-source **digital twin** of the Mcity test facility, Darian converted 3D assets into USD format, preparing them to be SimReady for effective integration with **NVIDIA Omniverse**.

Before adopting OpenUSD and Omniverse, simulating high-fidelity sensor data was difficult. Early

simulators did not support high-fidelity sensor models, and generating synthetic datasets for AI training was incomplete. However, the integration of OpenUSD dramatically changed his team’s workflow—enabling quick iteration on SimReady assets, automating scene management via the Python SDK, and more reliably generating data for AI model training.

Darian’s favorite feature of OpenUSD is the Python SDK, which enables him to manage and update scenes, assets, and metadata—offering flexibility that has significantly sped up asset preparation and customization. Overall, these capabilities have significantly enhanced development workflows—boosting efficiency,



improving collaboration across teams, and creating a more reusable and consistent digital twin ecosystem.

From accurately modeling lighting and material behavior to simulating rare and safety-critical driving scenarios, OpenUSD and Omniverse let researchers better replicate and analyze real-world challenges in autonomous vehicles. In the future, Darian aims to further improve their digital twin to minimize the “sim-to-real” gap—the difference between simulation and real-world results—and to help accelerate the safe deployment of **autonomous vehicle** technologies.

Learn more about **Darian’s work**.

# Rosy Xi Luo

## CEO



"We collected 8,000 real-world images in three years—but using Isaac Sim and OpenUSD, we generated 200,000 synthetic images with annotations in just one week. That diversity boosted our model accuracy by 11%."

Dr. Rosy Xi Luo is the Founder and CEO of Raygen Innovation, a leading force in AI and robotics with a mission to enable harmonious human-robot collaboration. With nearly two decades of experience in autonomous systems, Rosy has contributed to major advances in synthetic data generation, robotics simulation, and perception algorithms. OpenUSD was a key resource for Rosy as she worked to address real-world inspection and automation challenges—especially those focused on data scarcity and human-machine collaboration.

Implementing OpenUSD has helped address debugging costs, stakeholder

misalignment, and sluggish development cycles. Rosy's team, through OpenUSD, can generate high-quality synthetic data, test robotic systems in physically realistic environments, and collaborate on cross-disciplinary R&D with partners across China and the EU. Technologies like Isaac Sim and Omniverse build on OpenUSD as their foundation, enabling teams to simulate workflows—from robotic arm placement to tunnel safety validations—using modular assets, accurate physics, and intuitive collaboration tools.

Rosy also leads international co-creation workshops using OpenUSD,

bringing together robotics hardware manufacturers, AI developers, and infrastructure managers to focus on real deployment scenarios. From tunnel maintenance automation to deploying quadrupedal robots in mountainous terrain, OpenUSD enables real-time visual validation, regulatory pre-compliance testing, and rapid iteration in immersive visual environments. In the future, Rosy sees OpenUSD as the key to bridging China's fast-moving robotics innovation with European sustainability standards, shaping the next world of **physical AI**.

Learn more about [Rosy's work](#).



# John Mitchell

Structural  
Digital Specialist



“OpenUSD gives us a common digital language; Omniverse turns it into an interactive, decision-ready platform to plan, solve, and simulate—before we pour a single yard of concrete.”



John Mitchell is a Structural Digital Specialist at BMW Manufacturing’s Plant Spartanburg, leading innovation and digitalization efforts across the facility. With over 25 years of experience, much of his work is focused on digital twins, robotics, and immersive simulation. After first discovering OpenUSD and NVIDIA Omniverse technology libraries in 2020, John has championed their integration within **BMW's industrial metaverse** platform—a suite of digital twin applications transforming how teams collaborate on the factory floor.

Before the development and adoption of these OpenUSD-based applications, coordinating across CAD models, scan data, and production layouts

was time-consuming and siloed. By building their platform on an OpenUSD foundation, BMW teams are able to simulate, visualize, and validate entire facilities—from new battery lines to expanded assembly halls—in a shared, virtual environment before construction begins. The platform also enables BMW teams to combine data from different tools and supports non-destructive, layered collaboration: allowing teams to work independently on mechanical, structural, and robotics layers, with all changes preserved and without conflicts.

With these OpenUSD-based workflow solutions, teams have experienced up to 30% efficiency gains in production planning, reduced costly real-world

validation visits by as much as 70%, and accelerated project timelines. John is expanding BMW's capabilities with OpenUSD and building new solutions based on the **Mega NVIDIA Blueprint**, enabling AI agents to pilot and train autonomous systems within the plant. He champions open standards and collaborative platforms to further power **industrial AI** in intelligent automotive manufacturing.

Learn more about [John's work](#).

# Mustafa Mohammadi

**Simulation Engineer  
and Head of Growth**



“OpenUSD enables efficient searching and querying of 3D assets and data. Its modular structure makes workflows more flexible, enabling sophisticated refinement and iteration in robot training environments.”

Mustafa Mohammadi, Simulation Engineer and Head of Growth at Lightwheel, specializes in **humanoid** and quadruped robotics. He has a decade of experience in machine learning, robot training, and asset creation. His expertise sits at the intersection of advanced simulation and user-centric workflow optimization. Mustafa was first introduced to Isaac Sim, and then to OpenUSD tools within Omniverse, which proved transformative for robot simulation.

The core challenge for Mustafa was determining the right tool to solve specific problems. Tools like **USD Search** and **USD Code** became

crucial, enabling targeted, intent-driven searches and modular scene management. Before implementing OpenUSD features, pipelines lacked flexibility and refined control over assets and robot training pipelines, especially in large and complex environments.

OpenUSD and Omniverse have dramatically accelerated robot training cycles by supplying assets, models, frameworks, and algorithms that are ready to use—not only reducing setup time, but facilitating powerful script-driven training and inference runs. OpenUSD’s modularity enhances the user experience, ensures

seamless integration with emerging tools, and establishes new channels for third-party connectivity. Mustafa aims to continue using OpenUSD as the foundation for modular, scalable, and highly interactive engineering ecosystems.

Learn more about [Mustafa’s work](#).

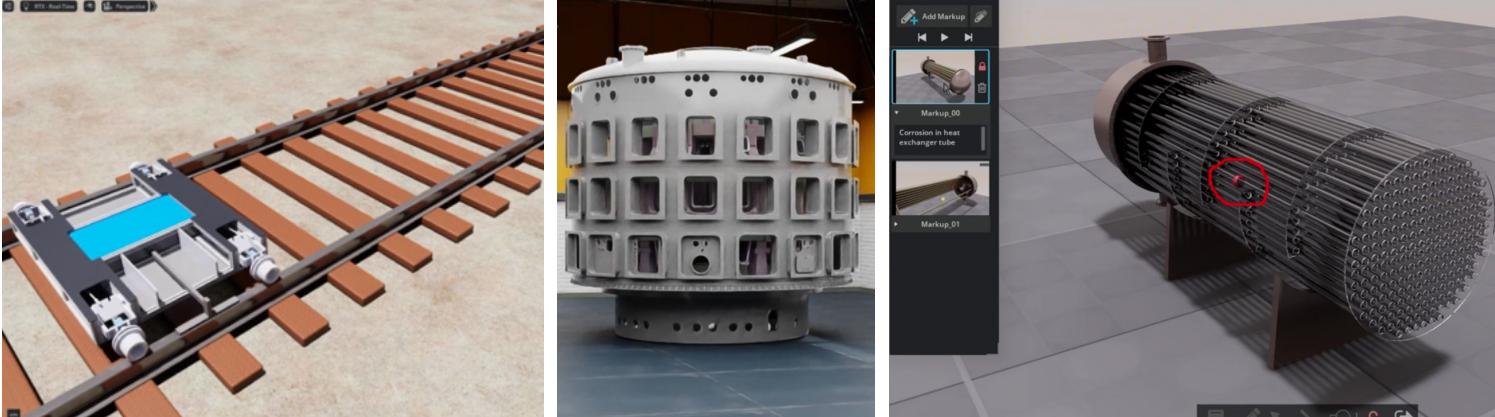


# Nandu Vellal

CEO



“OpenUSD and Omniverse enabled me to bring sensor data from inspection and overlay it on the CAD of the part - something no other platform has made possible.”



Nandu Vellal, CEO of nAurava Technologies, has over 30 years of experience in mechanical engineering, 3D visualization, and digitization of industrial inspection. He discovered his calling in building robotic inspection solutions after decades in product design and enterprise IT. His work enables him to channel his passion for problem-solving into Industry 4.0 applications for sectors such as energy and aerospace.

He first encountered OpenUSD in the early days of **NVIDIA IsaacSIM** while searching for advanced tools to simulate inspection scenarios. Traditional CAD systems were unable to support the creation of interactive, 3D digital twins. OpenUSD and Omniverse made it possible to

import sensor data, overlay it directly onto CAD models, and provide NDE/NDT inspectors with a far deeper understanding of defects—thus lowering the cognitive load and reducing the need for subjective guesswork.

Additionally, for industrial inspection, issues like defect size, shape, and orientation were once abstract and difficult to communicate. Now, OpenUSD's data sharing allows vital information to flow smoothly between inspection, maintenance, and product design groups, driving greater collaboration, ownership, transparency, and efficiency in their workflows.

OpenUSD has unlocked new visualization possibilities: inspectors can now experience immersive,

data-driven environments that contextualize sensor datasets, while executives and engineers access real-time interactive overviews of asset health. When Nandu presents at industry conferences, he promotes OpenUSD as the glue that binds together digital engineering, next-generation robotics, and AI—creating robust solutions to optimize and sustain industrial assets.

Looking to the future, Nandu states that OpenUSD is not only solving inspection challenges but also serving as a foundational technology for a sustainable planet - enabling better planning, reducing costly mistakes, and supporting asset health across the entire lifecycle.

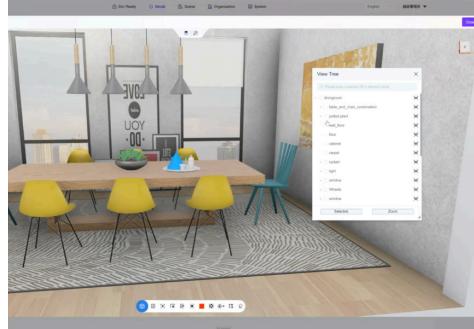
Learn more about **Nandu's work**.

# YouSong Xue

CEO



"The non-destructive features of OpenUSD make it possible to seamlessly update large digital twin projects as CAD and BIM data changes, making collaboration truly efficient."



YouSong is the CEO of Extwin and a technical expert in **digital twin** technology, with over 21 years of experience in product development. His development team creates digital twin engines and solutions, with their Multiverse engine powering thousands of major projects, including large-scale national initiatives. He is an expert at WebGL, 3D processing, and large-scale model rendering and has helped write and review industry-level digital standards, holding several invention patents. Recently, his focus has shifted to generating 3D synthetic data for embodied intelligent simulation training, further expanding his impact in the field of innovative simulation technologies.

YouSong's OpenUSD journey began when he adopted Omniverse to elevate digital twin project development, including advanced simulation training

with Isaac Sim. Before using OpenUSD, YouSong's team faced two critical limitations: rendering complex digital twin scenes in real time through web-based tools was virtually impossible, and efficiently managing the ever-evolving data from diverse sources typical in large infrastructure projects proved very difficult.

Since adopting OpenUSD, YouSong and his team have been able to seamlessly integrate and update multi-version CAD and BIM models across a range of projects, from airport and water conservancy to embodied intelligence simulations. The platforms' modular approach only requires updates to the necessary parts of a model, dramatically simplifying version management and enhancing efficiency through multi-year project lifecycles.

OpenUSD also supports an integrative bridge for CAD, BIM, and synthetic simulation assets, enabling high-quality, SimReady 3D models for robotics and simulation training. This integration facilitates smoother collaboration across various teams and project stages, leading to more agile and effective development workflows. As a result, YouSong's pipeline is now more streamlined and responsive to the constant updates and changes inherent in real-world digital twin deployments. YouSong plans to continue using OpenUSD, aiming to further integrate a variety of asset types—like SimReady and **3D Gaussian splatting models**—to build even more advanced virtual training platforms for embodied intelligent simulation.

Learn more about **YouSong's work**.

# Resources to Get Started

## 1. Learn

- > Accelerate your workflows with free [Learn OpenUSD courses](#).
- > Catch weekly OpenUSD Insiders [livestreams and office hours](#) on YouTube.

## 2. Explore

- > Get inspired by OpenUSD developers and 3D practitioners with the [Into the Omniverse](#) series.
- > Start developing OpenUSD applications using [NVIDIA Omniverse SDKs and libraries](#).
- > Check out [OpenUSD resources for developers](#) including pre-built libraries, sample assets and more.

## 3. Connect

- > Join the Omniverse community on [Discord](#).
- > Get answers and tips in the [NVIDIA forums](#).
- > Follow Omniverse on [Instagram](#), [LinkedIn](#), [X](#) and [YouTube](#).

# Get OpenUSD Certified and Become an All-Star



Take the next step in your 3D development career with [OpenUSD certification](#)—an industry-recognized credential that validates your ability to build, maintain, and optimize 3D content pipelines using OpenUSD.

To prepare for the exam, review the [OpenUSD Certification study guide](#) and enroll in the [Learn OpenUSD](#) learning path. Each course is designed to help you master foundational USD knowledge, ensuring you're ready to excel both on the exam and in real-world 3D projects.

## There's More To Discover

Learn more about OpenUSD.

[usd.nvidia.com](https://usd.nvidia.com)

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