

MACHINE LEARNING COMMITTEE

2024-2025 REPORT

Committee chair: Arjun Srinivasan

Board liaison: John Eastwood

Staff liaison: Annabella Betancourt

EXECUTIVE SUMMARY

The Machine Learning (ML) Committee refined and communicated an updated mission and 2025 strategic plan to align SEG's artificial intelligence (AI) and ML initiatives with the Society's vision for a "fourth digital revolution" in exploration geophysics. The committee initiated a focused portfolio of activities across wavefield methods, physics-informed ML, automated processing, and generative AI/large language models (GenAI/LLMs) to accelerate adoption within technical workflows and SEG operations. In addition, the committee launched an engagement and communication strategy to grow the ML community, identify champions in industry and academia, and explore GenAI applications for the SEG Digital Library, peer review, and content discovery.

HIGHLIGHTS FROM THE PAST YEAR

2024-2025 Priorities and Strategic Plan

During the 2024-2025 committee year, the committee focused on defining a clear 2025 strategic plan and a portfolio of technical priority areas. These priorities include:

- AI in wavefield methods, including AI-accelerated inversion and uncertainty quantification;
- Physics-informed ML, integrated with quantitative interpretation (QI) and rock physics;
- Automated processing workflows, including denoising, facies classification, and salt-body prediction; and
- Applications of GenAI/LLMs to SEG operations such as peer-review assistance, knowledge indexing, and content tagging.

These initiatives support broader SEG efforts, including SEAM AI and machine-learning-focused workshops that provide benchmark data sets and practical case studies for the membership.

Engagement and Communication

The committee implemented an engagement and communication strategy designed to cultivate a community of geoscientists interested in AI and ML. Key activities included:

1. Identifying champions and points of contact within operating companies, service companies, academia, and technology providers.

2. Coordinating with other SEG technology committees on cross-cutting topics such as full-waveform inversion (FWI), carbon capture and storage (CCS), and integrated subsurface characterization.
3. Highlighting SEG publications and educational offerings focused on ML, including recent books, training materials, and workshops on machine-learning methods in geoscience.

Technical Program and Events

The committee supported several ML-focused technical activities throughout the year. Notably, it promoted participation in the 4th Joint SBGf/SEG Workshop on Machine Learning, held 3-4 December 2024 in Rio de Janeiro, which brought together participants from academia, oil and gas, mining, and technology sectors to discuss ML adoption in geoscience research and industrial applications.

The committee also monitored and supported planning for SEG-wide initiatives such as the Advancing Data Analytics and Machine Learning for Exploration Geophysics workshop scheduled for May 2026 in Houston. Working closely with SEG staff, the committee helped ensure that topics such as benchmark data sets, physics-informed ML, and responsible AI practices remain visible to the ML community and its stakeholders.

GenAI and SEG Operations

Recognizing the rapid evolution of generative AI, the committee began exploratory work on how large language models could support SEG operations. Building on the strategic plan, the committee identified potential applications such as drafting and triaging peer-review correspondence, tagging and summarizing content within the SEG Digital Library, and enabling question-answering over SEG publications through fine-tuned LLMs. These concepts are intended to complement ongoing digital-transformation efforts across the Society and to create potential new revenue streams by improving the discoverability of SEG content.

Challenges and Next Steps

As in previous years, the committee continues to face challenges associated with volunteer availability, as many experts in AI and ML hold demanding industry roles. To address this, the committee broadened its volunteer base, formalized sub-team roles (technical themes, communications, events, and operations/GenAI), and strengthened collaboration with other SEG technology committees and initiatives such as SEAM AI and CCUS-related groups.

In the coming year, the committee plans to:

1. Fully operationalize the engagement and communication strategy;
2. Develop at least one demonstrator showcasing ML or GenAI applied to SEG content (e.g., an LLM-powered interface to curated segments of the SEG Digital Library); and
3. Continue supporting SEG meetings, workshops, and publications that advance practical ML adoption in exploration geophysics.