

# Leveraging Deep Learning for Enhanced Seismic Processing

---

**Area of Expertise:**  
Exploration

**Enterprise Solution:**  
ThinkOnward Projects

---

In upstream oil & gas exploration, the need for accurate seismic processing algorithms is paramount. The two-phase project represents an innovative effort to enhance the efficiency and accuracy of traditional geoscience workflows' through the application of machine learning methodologies. ThinkOnward crowdsourced outside perspectives to test a one-step seismic processing approach and demonstrate the value of testing new technology.

## Challenge

The client, represented by a geophysics team from a super major, sought to enhance its existing seismic processing workflow by exploring the application of deep learning techniques. Specifically, it aimed to improve upon a two-step processing approach currently in use, which plays a crucial role in tomography inversion for seismic imaging and velocity model determination.

## Solution

The proposed solution involved leveraging external expertise in deep learning and signal processing to develop a novel approach to seismic processing. The goal was to train a deep neural network model capable of replacing the existing two-step processing approach with a more efficient and parameter-independent one-step solution. Additionally, the project aimed to serve as a learning exercise for the sponsor team, highlighting the potential of integrating unconventional methodologies and external expertise into traditional geoscience practices.



## Implementation

Leveraging ThinkOnward's seasoned project team and crowdsourcing model, the projects were matched with two experts-in-residence (XiRs) in two phases. The XiRs were previous ThinkOnward Challenge winners who brought expertise in voice signal processing. This out-of-domain knowledge was applied innovatively to address the geoscience data processing problem at hand. The project, conducted over three months on a part-time basis on synthetic data, delivered two distinct solutions utilizing different approaches. The subsequent project, conducted over two months on a full-time basis on real data, then improved upon the findings from the first project.

## Result

The project served as a proof point for the efficacy of leveraging external expertise in tackling complex geoscience challenges. The XiRs demonstrated exceptional agility and proficiency in quickly grasping the project requirements and delivering proof-of-concept solutions within a remarkably short timeframe. This highlighted the potential for unconventional methodologies to enhance existing workflows and drive innovation in the field of seismic processing.

Inspired by the project results, the client was able to implement a less resource-heavy in-house solution of their ML-based seismic processing workflow. This would not have been possible without the learnings from this project. Furthermore, the success of this project led the client to envision future collaborations in the field of R&D and software development to allow the client to balance their workload and gain access to needed skillsets.

## Conclusion

The successful execution of the first phase of the project laid the groundwork for further exploration and development in the subsequent project. Building upon the insights and learnings from phase one, the second phase aimed to refine and optimize the deep learning approach using proprietary data and is currently being integrated by the client into their workflow for further testing. Overall, the projects underscored the value of collaboration between traditional geoscience practices and emerging technologies, showcasing the potential for transformative advancements in energy optimization and exploration.

- **Exploring New Technology** - AI was applied to traditional workflows resulting in the development of a one-step seismic processing solution that had not previously been tested.
- **Innovative Problem-Solving** - The use of crowdsourcing and out-of-domain expertise allowed for unconventional methodologies to be applied to traditional geoscience practices.
- **Potential Advancement** - The project showcased the potential for transformative advancements in energy optimization and exploration.

Learn more at [ThinkOnward.com](https://thinkonward.com)

Follow us on LinkedIn 