HUB TECH IA

Deliverable report 44

AI and IAGEN Application Use Case

Monitoring and Maintenance of Equipment for the detection of anomalies in equipment using artificial vision to anticipate failures and optimize maintenance

Executive Summary – Application of IAGEN and Computer Vision for Maintenance Predictive in Vaca Muerta

This executive summary presents a strategic application of generative artificial intelligence (GENAI) in the energy sector, focused on equipment monitoring and maintenance using computer vision. This represents a concrete opportunity for

optimize the operation in Vaca Muerta, both in hydrocarbon production and

in renewable energy, improving the efficiency, safety and sustainability of

processes.

Use case classification

The report classifies this IAGEN application based on four axes:

1. By main resource: oil, gas, water and renewable energy (classification

      comprehensive).

2. By activity: optimization of production processes.

3. By technology: generative models (GANs, VAEs, diffusion models), vision

artificial (CNNs, Vision Transformers), machine learning, edge computing, natural language processing and big data platforms.

4. By strategic impact: optimization of production and infrastructure energetic.

1. Opportunities for using AI and IAGEN in the sector

Opportunities focus on early fault detection, inspection automatic energy infrastructure and simulation of operational scenarios. Specific applications such as predictive analysis of pump failures stand out, turbines, pipelines or solar panels; environmental monitoring; and the improvement of planning and security through real-time video analysis and generation of synthetic images for model training.

2. Expected benefits

The adoption of these technologies allows:

- Increase the availability and useful life of critical equipment through predictive maintenance.
- Reduce operational downtime and repair costs.
- Improve occupational and environmental safety with real-time monitoring and alerts smart.
- Optimize energy performance and support the transition to a more sustainable.
- Accelerate decision-making from processed visual data automatically.

3. Application of AI

The proposed approach integrates computer vision and generative models within a flow

work that covers the capture of visual data with sensors and cameras, its analysis predictive through IAGEN, automatic optimization of operating parameters and generation of maintenance reports. In addition, improvement and restoration are applied of images in adverse conditions and the automatic generation of subtitles and metadata.

4. Proposed AI Agent

The report proposes the design of an artificial intelligence agent powered by IAGEN, conceived as an autonomous system capable of integrating visual data from sensors and cameras, analyze them in real time, identify patterns of abnormal operation and predict possible failures in critical machinery. This agent combines advanced generative models with learning algorithms deep and edge computing, allowing it to operate even in environments with Limited connectivity, such as those that characterize many of the operations in Vaca Dead. Unlike traditional systems, this agent requires no intervention. operator's constant, but rather executes tasks continuously and autonomously, including the generation of automatic reports, preventive alerts and tuning recommendations to optimize equipment performance.

Its main benefit lies in the automation of the entire maintenance flow. predictive, which allows to significantly reduce the response time to failures, minimize operating costs and increase the availability of critical assets. In addition, This agent can integrate with existing digital platforms, interact with databases, CRMs or SCADA systems, and continuously learn from them operational data it collects. This ability to constantly adapt makes it a key tool for scaling operations with efficiency and control, aligning the productivity objectives with greater operational sustainability.

5. Conclusion

The incorporation of IAGEN and artificial vision in Vaca Muerta represents an innovation

transformative for the Argentine energy industry. These technologies enable a predictive maintenance strategy and continuous monitoring that goes from reactive models towards a smart, safe and efficient operation. Its Strategic implementation can turn Vaca Muerta into a leading node of energy technology adoption, combining intensive resource exploitation with long-term sustainability.