Sharper, Faster, Smarter: Focoos AI Vision Running on Lenovo Power

How Focoos AI and Lenovo Are Transforming Computer Vision in Manufacturing

Introduction and Scope

The increasing complexity of manufacturing processes has heightened the demand for advanced technologies that ensure optimal production quality and operational efficiency. Traditional manual inspection methods are often slow, prone to human error, and difficult to scale, making it challenging to meet stringent quality control standards. As a result, AI-powered computer vision solutions have emerged as key enablers for real-time defect detection and anomaly identification. These solutions promise to automate critical tasks, such as quality control and anomaly detection, which are essential for maintaining high production standards and minimizing operational inefficiencies. However, while widely adopted object detection frameworks such as YOLO (You Only Look Once) and DETR offer general-purpose solutions, they often suffer from low performance, due to occlusion, varying lighting conditions, or high latency which is impractical for high-speed processing, limiting real world applications.

In this context, Focoos' AI-powered models offer a potential solution by providing custom-built object detection systems tailored specifically for industrial use cases. The current report details the results of a pilot project conducted to validate the technical and operational advantages of Focoos' models in a manufacturing setting, focusing on two critical use cases: (1) **Screw Detection** and (2) **Cable Damage Detection**. These tasks are crucial for ensuring quality and safety in the manufacturing process and Focoos' models were evaluated to assess their effectiveness in addressing these challenges compared to state-of-the-art alternatives. The pilot also aimed to evaluate how well these models generalize across different contexts by leveraging benchmarks such as the **COCO (Common Objects in Context) dataset**, a widely recognized standard for object detection performance, and the **Roboflow-100 benchmark**, which offers industrial-specific datasets for evaluating real-world applications.

To comprehensively assess the models' capabilities, key performance indicators (KPIs) were established, including **accuracy**, measured by mean Average Precision (mAP), and **efficiency**, evaluated using frames per second (FPS). These metrics are essential for determining the models' precision in detecting objects, as well as their ability to operate in real-time environments—crucial for production settings. Lenovo hardware, in particular a **Lenovo ThinkSystem SR670 V2 server equipped with NVIDIA L40S GPUs,** was employed to

simulate typical industrial conditions, further ensuring the relevance and applicability of the results in a manufacturing context.

Focoos AI Technology

Focoos AI leverages cutting-edge neural network architectures to deliver highly efficient and accurate computer vision models, tailored specifically to meet the unique demands of industrial environments. Unlike general-purpose AI models, which may struggle with the nuances of manufacturing tasks, Focoos AI models are designed to optimize both performance and precision. By focusing on efficiency, Focoos AI ensures that its models can process data quickly with minimal computational overhead, making them ideal for real-time applications such as quality control, anomaly detection, and worker safety monitoring. At the same time, these models maintain high accuracy, enabling precise detection of objects and anomalies, even in challenging industrial environments.

One of the key advantages of Focoos AI is the emphasis on **customization**. Our models are not one-size-fits-all solutions; instead, they are specifically tailored to the datasets and operational needs of each client. This customization ensures that the models are highly relevant to the specific manufacturing tasks at hand, leading to superior accuracy and robustness. Additionally, the models are optimized for the client's target hardware, allowing them to run efficiently on the available infrastructure and reducing unnecessary resource consumption.

Focoos AI Platform

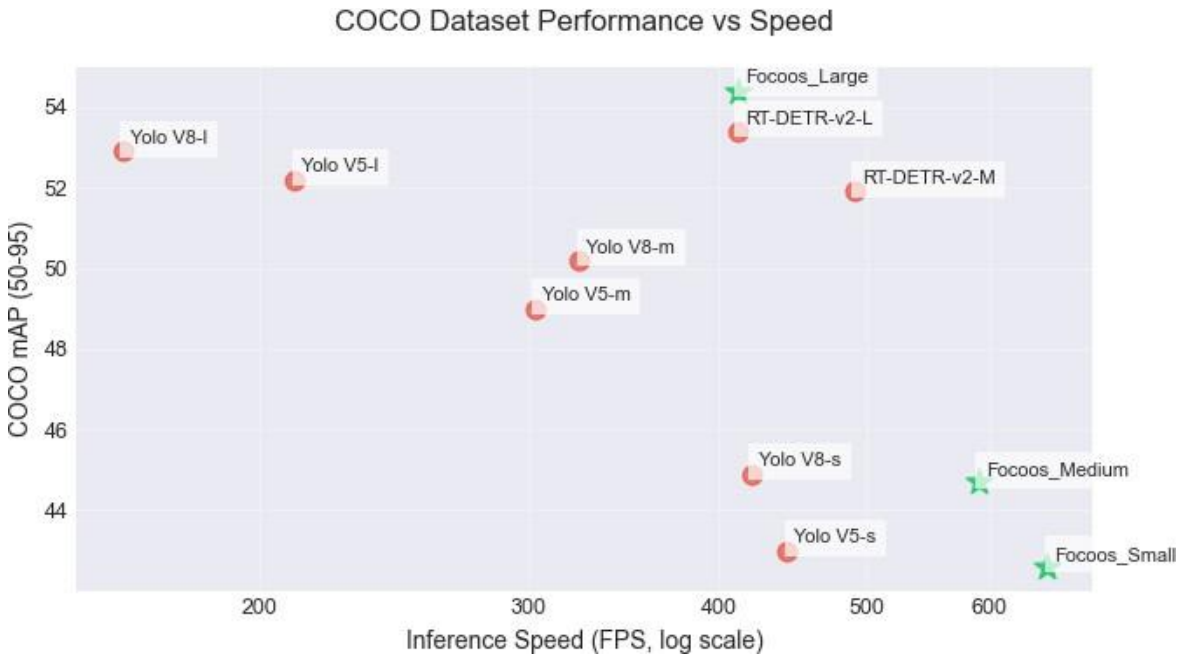
The Focoos AI platform is the operational backbone that brings our high-efficiency models, designed with our technology, into real-world industrial settings. Designed with usability and performance in mind, the platform provides a centralized environment where developers can manage the entire AI development pipeline without the need for being machine learning experts. From data ingestion to deployment, the platform offers a guided and modular approach that reduces the complexity typically associated with computer vision solutions. Whether the objective is quality inspection, predictive maintenance, or geospatial image analysis, the platform enables users to build, train, and deploy models that are not only accurate but also optimized for real-time performance on their existing hardware infrastructure.

At the core of the platform is a user-friendly web interface that facilitates seamless interaction with Focoos AI's models. Users can upload dataset and initiate training processes directly from the browser. Throughout the process, smart validation and feedback mechanisms ensure that each step, from data quality checks to model evaluation, is transparent, traceable, and optimized for high performance. This empowers everyone to experiment and iterate quickly, accelerating the time-to-value for AI solutions without compromising on quality.

Each component of the platform, from model customization to API endpoints, is backed by comprehensive, developer-friendly documentation that includes examples, best practices, and usage guidelines. We understand that even the most powerful technology needs to be accessible to deliver value, which is why we've invested in making our documentation clear, searchable, and actionable.

Pilot Results

Generic Dataset (COCO) Performance



In this section, we present the performance evaluation of Focoos AI models compared to industry-standard solutions. The comparison was conducted using identical datasets and a consistent experimental setup to ensure a fair evaluation. Both Focoos and baselines models were trained with comparable learning rates and training iterations, allowing for a direct performance comparison across key metrics such as accuracy and efficiency.

For YOLO, we utilized the Ultralytics repository, which provides an accessible and widely adopted implementation of the YOLO object detection framework. YOLO V8 models of various sizes—small (V8-s), medium (V8-m), and large (V8-l)—were used as benchmarks to assess the relative performance of Focoos AI models. The YOLO models were trained and evaluated under similar conditions to Focoos, including the same dataset splits and performance metrics. RT-DETR has been implemented by using its official authors' repository. .

The results demonstrate the clear advantages of Focoos AI models, both in terms of accuracy and efficiency. Focoos' **large model** achieved the highest **average precision (AP)** among all tested models, with an impressive score of **54.4**, outperforming competitive solutions such as

YOLO V8-L (52.9) and **RT-DETR-v2-L (53.4)**. This indicates that Focoos AI is capable of achieving superior object detection performance in industrial tasks, where precision is crucial for detecting small or subtle anomalies. Furthermore, Focoos' model outperformed the YOLO models in **FPS** (frames per second), with the smallest model achieving **655 FPS**, significantly higher than the YOLO V8-L model's **163 FPS**. The efficiency of Focoos' model ensures its suitability for real-time applications, where the ability to process data quickly is just as important as accuracy.

Model	COCO (AP50-95)	FPS
Focoos	**54.5**	**411**
RT-DETR-v2-L	53.4	410
YOLO V8-l	52.9	163
YOLO V8-m	50.2	324
YOLO V8-s	44.9	420

The superior performance of Focoos AI models can be attributed to the platform's **customization capabilities** and **hardware optimization**. Unlike YOLO, which is a general-purpose object detection framework, Focoos AI allows users to upload and tailor their data to create models that are optimized for specific manufacturing environments. The platform also facilitates easy deployment of models on the client's target hardware, ensuring both efficiency and accuracy are maximized based on the operational context.

Overall, these results confirm that Focoos AI provides a **superior trade-off** between **accuracy** and **efficiency**, making it a more suitable solution for real-world industrial applications where both factors are critical. The ability to deploy highly accurate models that perform efficiently in real time positions Focoos AI as a leader in industrial computer vision technology.

Screw Detection

In the **Screw Detection** task, Focoos' models demonstrated exceptional performance, achieving the highest **AP50** score of **78.8** among all models tested. This result highlights the superior accuracy of Focoos AI in detecting screws—an essential task in quality control within manufacturing environments. While the **FPS** for the Focoos model was slightly lower than the standard configuration, it still maintained impressive efficiency with **655 FPS**, demonstrating its capability to operate in real time without sacrificing accuracy.

In comparison, the YOLO models also performed well, but Focoos outperformed them across all tested versions. The **YOLO V8-s** model achieved a **Screw AP50 of 73.1** with **420 FPS**, while the **YOLO V8-m** and **YOLO V8-L** models achieved **74.3** and **75.1** AP50, respectively, with decreasing FPS as the model size increased. The **YOLO V8-L** model, despite its larger architecture, only achieved **163 FPS**, indicating a significant trade-off in efficiency at higher accuracy levels.

Model	Screw (AP50)	FPS
Focoos	**78.8**	**655**
YOLO V8-l	75.1	163
YOLO V8-m	74.3	324
YOLO V8-s	73.1	420

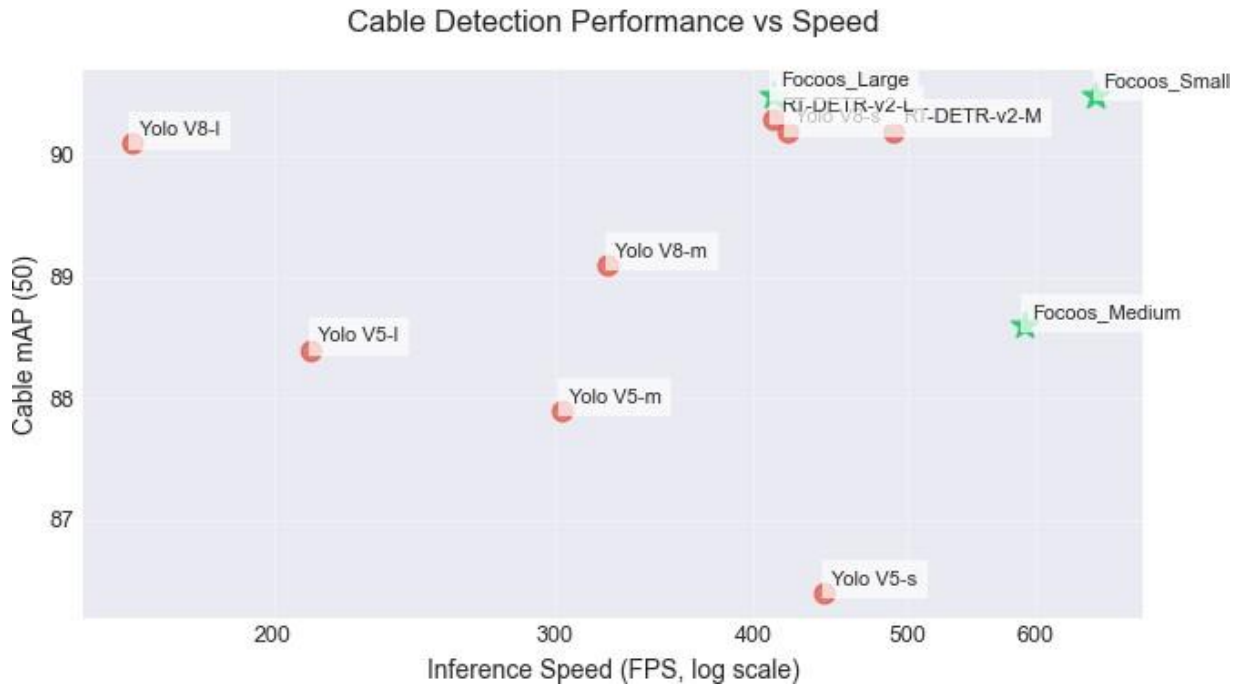
These results demonstrate that Focoos AI is particularly well-suited for quality control tasks, where precision and speed are paramount. The **Focoos model** achieved the highest accuracy while maintaining an outstanding FPS, underscoring its ability to perform real-time detections without compromising precision. In contrast, while YOLO models provided competitive accuracy, they suffered from reduced efficiency as the model size increased, making them less suitable for real-time industrial applications.

Additionally, Focoos AI models were deployed and tested on **Lenovo's high-performance hardware**, which further optimized their efficiency. This hardware setup allowed Focoos AI to

maintain both high accuracy and high FPS, ensuring that the system could handle large volumes of data in real-time without causing delays in production lines.

Cable Damage Detection

In the **Cable Damage Detection** task, Focoos AI's models achieved an outstanding **AP50** score of **90.5**, the highest among all models tested. This performance highlights Focoos' exceptional accuracy in detecting cable damage, an essential aspect of ensuring product quality and safety in manufacturing environments. The **Focoos model** also demonstrated remarkable **efficiency**, achieving **655 FPS**, which significantly outperformed the other models in terms of real-time processing speed. This combination of high accuracy and speed makes Focoos AI particularly suitable for high-throughput manufacturing environments where both precise detection and quick decision-making are crucial.



In comparison, the **YOLO V8-s** model achieved a **Cable AP50** score of **90.2** with **420 FPS**, and the **YOLO V8-m** model achieved **89.1 AP50** at **324 FPS**. While these results are competitive, they fall short of Focoos' performance in both accuracy and speed. The **RT-DETR-v2-M** model achieved a **90.2 AP50** score with **410 FPS**, still below Focoos in terms of both accuracy and real-time processing capability.

Model	Cable (AP50)	FPS
Focoos	**90.5**	**655**
YOLO V8-s	90.2	420
RT-DETR-v2-M	90.2	410
YOLO V8-m	89.1	324

In conclusion, Focoos AI's performance in **Cable Damage Detection** underscores its ability to deliver accurate and efficient solutions for industrial quality control tasks. The combination of high accuracy and high FPS positions Focoos AI as a powerful tool for improving operational efficiency and safety in manufacturing settings.

Conclusion

Focoos AI offers a powerful solution for industrial applications, delivering **high accuracy** and **efficiency** in real-time object detection tasks. The ability to tailor models to specific datasets ensures that Focoos AI's technology is optimized for each use case, providing precise results even in complex and dynamic manufacturing environments. Moreover, Focoos AI models are designed to operate efficiently on client hardware, like the **NVIDIA L40S GPUs onboard of the Lenovo ThinkSystem SR670 V2 server,** minimizing computational overhead and enabling high-performance processing at scale. This combination of accuracy and efficiency makes Focoos AI an ideal choice for businesses looking to enhance their operational processes while maintaining speed and reliability.

In addition to its performance advantages, Focoos AI stands out for its **accessibility**. The user-friendly web platform allows businesses to easily upload their data, customize models, and deploy them without requiring deep technical expertise. This democratizes access to advanced AI technology, enabling a wider range of industries and businesses to leverage AI for critical tasks such as quality control or safety monitoring. By simplifying the traditionally complex process of AI model development and deployment, Focoos AI empowers users to quickly implement cutting-edge solutions and realize the benefits of AI without significant resource investments.

The collaboration between **Focoos AI and Lenovo** opens up significant opportunities to integrate state-of-the-art AI technology into cutting-edge hardware solutions, optimizing real-time applications and enhancing overall system performance. Together, the two companies aim to deliver seamless, high-performance, and cost-effective solutions that are fully tailored to the demands of modern manufacturing and industrial environments. Lenovo's powerful infrastructure, such as ThinkSystem SR670 V2 server, provides the ideal foundation for deploying Focoos AI's highly efficient computer vision models at scale, ensuring both speed and reliability in even the most demanding scenarios.

Looking ahead, this collaboration creates a platform for continuous innovation, with the potential to expand into new industries and tackle increasingly complex use cases. By combining Focoos AI's expertise in customizable, frugal AI with Lenovo's leadership in scalable hardware solutions, the partnership unlocks new pathways for digital transformation across the industrial sector. For Lenovo, it represents a step forward in offering customers truly intelligent infrastructure; for Focoos AI, it's an opportunity to scale its impact and bring next-generation AI to a broader global audience. Together, the two companies are not just enhancing current workflows, they're shaping the **future of industrial intelligence.**