White Paper

Intel® AI Technologies
AI Applications Development

CGI is simplifying and accelerating the AI development journey

AiFA by CGI, a low-code and no-code machine learning development platform part of CGI's next-gen managed services portfolio, powered by Intel® processors, democratizes AI development to enable reduction up to 90% effort and 25% training time.

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Executive summary

With consumers' ever-growing digital demands, traditional methods of software and service delivery are no longer sufficient. Adapting swiftly in a dynamic business landscape is proving to be the key differentiator for success. CGI's Voice of Clients 2023 research also reveals a correlation between business model agility and digital strategy results.[1] Organizations thus need to accelerate their execution by incorporating artificial intelligence (AI) and intelligent automation into their business processes.

Low-code and no-code AI programming solutions offer a revolutionary approach to AI application development enabling users to create new AI-based applications through intuitive user interface effortlessly. This not only streamlines the process but also alleviates the burden on skilled developers, often scarce in today's market. According to a Gartner report, it is projected that by 2025, approximately 70% of enterprises will adopt low-code and no-code technologies for developing their new applications.[2] This marks a significant shift in how organizations approach AI development.

CGI, one of the largest IT and business consulting services firms globally, maximized Intel® technologies to deliver an AI development platform called AiFA (Artificial Intelligence for All). The platform simplifies and accelerates the time-to-value of building and deploying AI and machine learning (ML) models through a low-code and no-code approach.

The need for low-code and no-code AI development platforms

Only 1 out of 6 trained AI models make it to production, and 94% of CIOs feel their teams don't have the required multi-disciplinary expertise such as data engineering, data science, ML, DevOps, among others, to build AI models.[3] Implementing low-code and no-code for AI application development thus holds immense potential for enhancing operational efficiency, forecasting customer attrition, and providing valuable recommendations to businesses across industries. Furthermore, a no-code and low-code approach can enable 50-90% reduction in development time and up to 20% reduction in IT spend.[4,5] With AiFA by CGI, even those with little to no coding knowledge can effortlessly create AI models, responsibly with a provision for human-in-the-loop to enable verification and corrections. These models can play a pivotal role in distinguishing between high-quality and defective products within manufacturing facilities or identifying individuals who may not be wearing masks in healthcare settings - the versatility of low-code and no-code AI knows no bounds. In sectors driven by data analysis, such as marketing, sales, and finance, businesses stand to gain significant advantages from leveraging low-code and no-code AI platforms.

> "At CGI, we are using AI as a force multiplier to accelerate IT and business transformation. We are helping clients transform their IT operations to improve efficiencies across the enterprise with smart tools, platforms, and intelligent automation."

Dr. Rahul Ghodke
Senior Vice President &
Business Unit Leader,
Asia Pacific Global Delivery
Centers of Excellence, CGI

Addressing real-world challenges of AI development

AI has emerged as the key factor that sets clients apart in today's competitive landscape, with both business and IT stakeholders recognizing its importance. However, building and implementing an AI model is time-consuming and often limited by pre-defined models, type of datasets, security, and performance.

AiFA by CGI addresses the challenges that the AI lifecycle presents to ensure optimal outcomes for developers and the business by offering:

- **Customization:** Unlike most AI platforms, it provides pre-built models with personalization options.
- **Best-fit Algorithm:** It offers the choice of algorithm to meet your needs and is not tightly coupled to any specific libraries.
- **Compatible to Varied Dataset/Datatype:** The platform can support large unstructured datasets effectively, with no limitations on the types of problems to be addressed.
- **Explainable AI:** Auto-ML platforms generate black-box models, which can be challenging to interpret and explain, potentially leading to regulatory or ethical concerns in certain applications. AiFA ensures secure and responsible code development and implementation.
- **Responsible AI:** Provision for human-in-the-loop (HITL) to enable verification, corrections and avoid bias.
- **Consistent High-quality Performance:** It delivers the same level of performance for custom-built models and for quick prototypes.
- **Execution with Speed:** The platform reduces the training from the typical 3-6 months to a few hours.

Democratizing AI through AiFA by CGI

Traditionally, AI development has been the domain of highly skilled data scientists and software engineers. However, the emergence of low-code and no-code AI development has revolutionized access to AI technology, empowering individuals from different technical and non-technical backgrounds to harness the potential of intelligent applications.

AiFA by CGI is an advanced layer two platform designed to facilitate the rapid development and deployment of ML models with utmost precision. By simplifying the intricate processes in creating AI models fit for production, AiFA empowers businesses and developers to deliver high-quality AI services while distinguishing themselves from standard IT offerings through embedded AI capabilities, such as IP suite services and internal operations. AiFA democratizes access to AI for users and is domain agnostic.

Even individuals with limited expertise in a particular field can effortlessly train, test, and securely deploy ML models to production at an accelerated pace. The platform effectively addresses common challenges encountered during model creation and implementation by enabling parallel training of diverse models using individual or ensemble algorithms, substantially reducing training time and costs. Furthermore, AiFA features an intuitive user interface that seamlessly guides users through all stages of the ML lifecycle while minimizing coding errors.

With AiFA's capabilities, users can swiftly and securely transition from raw data to fully trained ML models with just a few clicks. The efficiency and accessibility provided by this powerful platform empowers businesses to harness the potential of AI more effectively than ever before.

Delivering benefits of accelerated and simplified AI development

The AiFA platform significantly reduces processing time, facilitates effortless deployment, and minimizes errors by maximizing Intel hardware and software. Some of the key benefits the Intel-powered AiFA platform include:

- **Enhanced Accessibility:** No-code/low-code approach enables non-technical users to actively engage in the development process of ML. It democratizes AI and makes it accessible to a broad audience.
- **Faster Development:** Accelerates the model development process and significantly reduces the time and effort required for model development. This expedites the overall process of building and deploying ML applications.
- **Simplified Deployment:** The versatility of the solution allows trained and tested models to be effortlessly deployed across any environment with just a few clicks, whether on-premise or within a cloud infrastructure. This seamless deployment ensures smooth integration into any operational system.

- **Reduction in Errors:** The user-friendly nature and transparent functionalities contribute to a decrease in coding errors. Through intuitive visual interfaces or storyboards, complex processes are simplified and abstracted, enabling users to avoid potential pitfalls associated with intricate coding structures.
- **Extensive Algorithm Options:** Users can fully leverage the vast benefits provided through its extensive selection of algorithm combinations - an impressive 100,000 choices are available. Additionally, pre-defined integrations with top-tier ML libraries further enhance flexibility within the platform.
- **Integrative Layer Two Solution:** As a layer two solution, AiFA seamlessly integrates with third-party tools and platforms while harnessing its unique features and advantages. This integration capability expands possibilities for users who seek enhanced functionality from multiple sources simultaneously.
- **Unparalleled Explainability:** To foster transparency and ensure clarity throughout model recommendations, the platform offers reports along with leaderboards that provide detailed justifications behind each recommendation. A clear line is drawn between cause-and-effect relationships within the framework.

A powerful hardware platform for high-performing AI workloads

CGI needed a powerful platform that can support the high-performance requirement of AiFA. By collaborating with Intel, CGI optimized the AiFA platform by maximizing Intel® processor architecture including Intel® Xeon® processor and Intel® Core™ processor.

Testing and analyzing AI/ML models is a compute-intensive process. For the initial research and development (R&D) phase of AiFA, CGI relied on systems powered by the Intel® Xeon® Gold 6140 Processor technologies with up to 3.70 GHz CPU frequency. The Intel® Xeon® Scalable processor platform with Intel® Mesh Architecture, delivering up to 18 cores and 36 threads (per processor), the last level cache (LLC), and six memory channels shared across the entire die, makes it the ideal choice for the whole performance analysis workflow. Additionally, Intel® Advanced Vector Extensions 512 (Intel® AVX-512) brings the much-needed boost in performance and throughput for demanding tasks such as modelling and simulation, data analytics, and ML visualization in the R&D phase. Additionally, Intel® Xeon® Scalable processors support many gigabytes of memory enabling fast access to large datasets.

For the development phase, AiFA maximized the power of Intel® Core™ i7-1270P and Intel® Xeon® E5-2673 v4 processors. Intel® Core™ i7-1270P processor supports high-performing AI for inferencing and machine vision. The high number of graphics execution units (EUs) allow for a high degree of parallelization in AI workloads, while hardware-enabled AI acceleration on the CPU from Intel® Deep Learning Boost (Intel® DL Boost) and VNNI instructions provides additional inference processing power. It provides the performance needed for seamless development with the ability to accelerate deep learning AI at the edge that delivers new levels of object detection and image segmentation, as well as natural language processing.

During production, CGI leveraged the performance, I/O, and memory capabilities of Intel® Xeon® E5-2690 v3 processor with 4 NVIDIA T4 GPUs (16 GB of memory each). Low-power, high-reliability, and robust thermal profile processor options make this platform ideal for ensuring optimal TCO. Additionally, with up to 12 cores, 30 MB Intel® Smart Cache, and 2133 MHz DDR4 memory speed, it delivers the performance needed during the production phase. The platform also features Intel® Virtualization Technology for flexible virtualization, two Intel® QuickPath Interconnect (Intel® QPI) links, Intel® Turbo Boost Technology and Intel® Hyper-Threading Technology to achieve top performance for bandwidth-intensive applications.

Optimizing software to accelerate AI development

The multifaceted collaboration allows CGI to take advantage of the latest Intel® Xeon® Scalable processor innovations along with Intel software optimizations take advantage of the hardware features to bring significant performance speed-up to accelerate the end-to-end AI pipeline. Intel® provides a wide range of purpose-built software optimization tools and AiFA by CGI takes advantage of these software tools to simplify and accelerate the AI development lifecycle.

For processing structure data on the AiFA platform, CGI leverages Intel® Extension for Scikit-learn to enhance the performance of Scikit-learn applications on Intel CPUs and GPUs, both in single-node and multi-node configurations. It offers faster and more efficient training of ML models, particularly when running on GPUs. The extension utilizes Intel's oneAPI Data Analytics Library (oneDAL) and a set of Python modules for ML and data mining. By leveraging this extension, CGI was able to achieve improved performance while using the familiar Scikit-learn package for training ML models on structured data like fraud detection and cost optimization. By utilizing parallelism and vectorization, Intel's optimizations provide significant speed improvements for Scikit-learn's algorithms. This is key to training models faster and more efficiently, especially when dealing with large datasets or complex models.

AiFA also leverages the Intel® oneAPI toolkit, which includes tools and frameworks optimized for training ML models on unstructured data. This toolkit helps accelerate data analysis and ML workflows significantly, especially when dealing with unstructured data such as images, video, and audio. By maximizing Intel® oneAPI Unified Programming Model, which provides a unified programming interface, AiFA maximizes deep learning techniques based on well-defined neural networks to extract patterns and insights from unstructured data. The AI Kit maximizes performance from preprocessing through ML and provides interoperability for efficient model development.

For training Optical Character Recognition (OCR) models, AiFA uses Intel® Neural Compressor and TensorFlow. Intel® Neural Compressor is ideal for OCR applications since it significantly performs model compression to reduce the model size and increase the speed of deep learning inference. This open-source Python library automates popular model compression technologies, such as quantization, pruning, and knowledge distillation across multiple deep learning frameworks. Intel® Extension for TensorFlow is also used in tandem with Intel® Neural Compressor and uses a combination of text detection

Gaining the Performance Edge with Intel

10x
reduction in training time for seven million unstructured datasets

5x
faster performance for exploratory data analysis with Intel® Distribution of Modin

10x
faster results with the expedited training process without visible reduction in performance

Enabling real-world impact

The AiFA by CGI platform minimizes the level of expertise needed by data scientists, ML engineers/architects, and ML DevOps professionals when constructing AI models, leading to unprecedented efficiency gains.

By harnessing its capabilities, model training efforts have been dramatically **reduced** from a span of 3-6 months **to a few hours**.

The accelerated process enabled by AiFA can help businesses and developers realize **~90% effort reduction**.

Through the integration of Intel® libraries and infrastructure, **training time has been reduced** further by **25%**.

As a result of these advancements in technology, AiFA empowers users to seamlessly integrate intelligence into applications through a highly automated approach.

Conclusion

The emergence of low-code and no-code platforms has brought about a significant shift in the realm of AI application development. AiFA by CGI, powered by Intel, leverages this approach to effectively remove the barrier of technical coding skills, allowing a wider range of individuals and organizations to tap into the potential of AI.

In various sectors, real-world applications of low-code and no-code AI platforms are already making a profound impact. Businesses can now automate tasks, improve customer service, and make data-driven decisions effortlessly with the AiFA platform. Similarly, individuals can create personalized learning experiences, manage their finances more efficiently, and stay up-to-date with AI-powered applications. With AiFA by CGI, both businesses and individuals can gain newfound access to the transformative power of AI.

[1]Source: ROI-led digital transformation leads the C-suite business agenda – CGI Press Release

[2]Source: Gartner Says Cloud Will Be the Centerpiece of New Digital Experiences – Gartner Press Release

[3]Source: 2020 State of Enterprise Machine Learning Whitepaper – Corinium Report

[4]Source: Intelligent Process Automation and the Emergence of Digital Automation Platforms - Red Hat Pathfinder Report

[5]Source: LCAP TECHNOLOGY VALUE MATRIX 2020 - Nucleus Research Note