# Task No – 09: Solutions for FPGA Development Using AI

**Date –** 16th July 2024

**Members of team:** Nichenametla Yadhu Vamsi, Rashmi Singh, Chandan Kumar, Vishesh Chhaperwal, Kush Thakur, Ranga Sudharani, Khushi Prajapati

The integration of artificial intelligence (AI) in FPGA (Field-Programmable Gate Array) development has significantly advanced the capabilities and efficiency of FPGA design and deployment. AI-driven solutions streamline the design process, optimize performance, and enhance the functionality of FPGA-based systems. This survey report explores the leading solutions available for FPGA development using AI.

**1. Xilinx Vitis AI:**

* **Description:** Vitis AI is an AI development environment provided by Xilinx, designed specifically for FPGA and Adaptive SoC (System on Chip) platforms.
* **Features:**
  + Supports popular deep learning frameworks such as TensorFlow and Caffe.
  + Optimizes and deploys AI models on Xilinx devices.
  + Includes a comprehensive set of tools for model quantization, compilation, and deployment.
* **Advantages:**
  + Seamless integration with Xilinx hardware.
  + Extensive pre-optimized AI models and libraries.
  + Efficient performance and low power consumption.

**2. Intel OpenVINO Toolkit**

* **Description:** OpenVINO (Open Visual Inference and Neural Network Optimization) Toolkit by Intel is designed to accelerate AI workloads on various hardware platforms, including FPGAs.
* **Features:**
  + Supports deep learning model optimization and deployment.
  + Includes a model optimizer and inference engine.
  + Provides pre-trained models and supports custom model integration.
* **Advantages:**
  + Cross-platform support for Intel CPUs, VPUs, and FPGAs.
  + High performance with optimized inference capabilities.
  + User-friendly development environment with comprehensive documentation.

**3. Achronix Machine Learning Processor (MLP)**

* **Description:** Achronix provides FPGA-based solutions with integrated machine learning processors for AI acceleration.
* **Features:**
  + Customizable FPGA fabric with dedicated AI processing units.
  + High-bandwidth memory interfaces.
  + Support for popular AI frameworks.
* **Advantages:**
  + High performance and flexibility for AI applications.
  + Scalable architecture suitable for diverse workloads.
  + Efficient power consumption and high-speed data processing.

**4. Bluespec AI Design Tools**

* **Description:** Bluespec offers high-level synthesis (HLS) tools for FPGA development, incorporating AI-driven optimization techniques.
* **Features:**
  + HLS tools enable the conversion of high-level code into FPGA-optimized hardware.
  + AI-based optimizations for performance and resource utilization.
  + Support for complex AI algorithms and models.
* **Advantages:**
  + Simplifies FPGA design with high-level programming.
  + AI-driven optimizations enhance performance.
  + Flexible and powerful design environment.

**Conclusion:**

AI-driven solutions for FPGA development are revolutionizing the field by providing tools and platforms that enhance the design, optimization, and deployment of AI models on FPGAs. Leading solutions such as Xilinx Vitis AI, Intel OpenVINO, AMD Vitis, Achronix MLP, and Bluespec AI Design Tools offer comprehensive environments that cater to diverse AI applications. These tools not only streamline the FPGA development process but also ensure high performance, efficiency, and scalability, making them essential for modern AI-driven applications.

**REFERENCES: -**

Xilinx Vitis AI: <https://www.xilinx.com/products/design-tools/vitis/vitis-ai.html>

Intel OpenVINO Toolkit: [Link](https://www.intel.com/content/www/us/en/developer/tools/openvino-toolkit/overview.html?cid=sem&source=sa360&campid=2024_ao_cbu_in_gmocoma_gmocrbu_awa_text-link_brand_exact_cd_HQ-ai-openvino_3500231769_google_b2b_is_non-pbm_intel&ad_group=AI_Brand-Openvino_Openvino_Exact&intel_term=intel+openvino+toolkit&sa360id=43700079829618884&gad_source=1&gclid=CjwKCAjwtNi0BhA1EiwAWZaANNzPFunUA17ox1VOcX8EoeF-GSbxQblonW-WG9b-6YQzNZYl8ST5mBoCgcAQAvD_BwE&gclsrc=aw.ds)

Achronix Machine Learning Processor (MLP): <https://www.achronix.com/machine-learning-processor>

Bluespec AI Design Tools: https://bluespec.com