

# FPGA vs. GPU for Machine Learning - Sprint 1

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# Product Mission

- Our product will be designed to analyze and compare FPGA and GPU performance in machine learning applications
- Some ML applications that can be helpful:
  - Basic image processing
  - Language recognition
  - Text-to-speech
- Additionally, see how effective High Level Synthesis is at implementing code in hardware description language (HDL)

# Design MVP and User Stories

## MVP

- A repeatable ML model that can be run on various technologies to analyze how performance changes for GPU vs FPGA

## User Stories

- A machine learning application developer wants to develop an application that requires a fast execution speed and needs to decide between using an FPGA or GPU
- A developer wants to verify the performance of a particular cloud computing service that supports tensorflow frameworks
- A student new to machine learning wants to use FPGAs but is unfamiliar with HDL and needs to use high-level languages

# Evaluating Technologies for Machine Learning

- AWS
  - F1 - FPGA instances in the cloud
  - Sagemaker - build, create, and deploy ML models in the cloud
  - Hello world examples
    - Demonstrate an example application written in C that is synthesized to RTL (Verilog)
- TensorFlow
- Keras (was separate but now fully integrated)
- ML5.js - aims to make machine learning approachable for a broad audience
- PyTorch - computer vision and NLP library developed by Facebook AI Research (FAIR) Lab
- Others that are relevant



Amazon EC2



# Development Environment

- Amazon Web Services (AWS): Primary
  - Amazon EC2 F1 Instance
    - “Hello World” example from Project 1
  - AWS Sagemaker
  - AWS CLI
- Vivado Design Suite (primarily within AWS)
- BU Shared Computing Cluster (SCC)
  - Analyze resources available for ML

# Literature Review

- AWS EC2 F1 Instances (<https://github.com/aws/aws-fpga>)
- BU SCC (<https://www.bu.edu/tech/support/research/computing-resources/scc/>)
- Various Technology Documentation for implementation

Questions?