A Web-accessible Artificial Intelligence Platform for Real-time Analysis of Intraoperative Video Trainees

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Introduction

- Complications from surgery are one of the most significant sources of morbidity, mortality and costs in health care
- This problem is especially pronounced in remote, rural and developing regions of the world
- Artificial intelligence (AI) can be used to provide surgeons with real-time guidance & minimize risk of operative complications

We developed and tested a web-accessible platform that can be accessed remotely from any geographic location and used to run AI algorithms on a live-stream of surgical video without the need for specialized hardware.

Features

- Real-time Surgical Video Analysis
  - Highlight safe and dangerous areas of dissection
  - Stream video from multiple sources, including screen-share, built-in cameras and laparoscopic towers

- Model Sensitivity Customization
  - Built-in slider allows users to adjust model confidence threshold based on scenarios and user preferences

- Network Optimization
  - Flow control algorithm maximizes frame-rate for faster internet while minimizing latency for slower internet
  - Improves usability in locations with poor connections

- Distributed Computing
  - runs on four independent NVIDIA Tesla-P100 GPUs on UHN's private cloud to reduce risk of failure
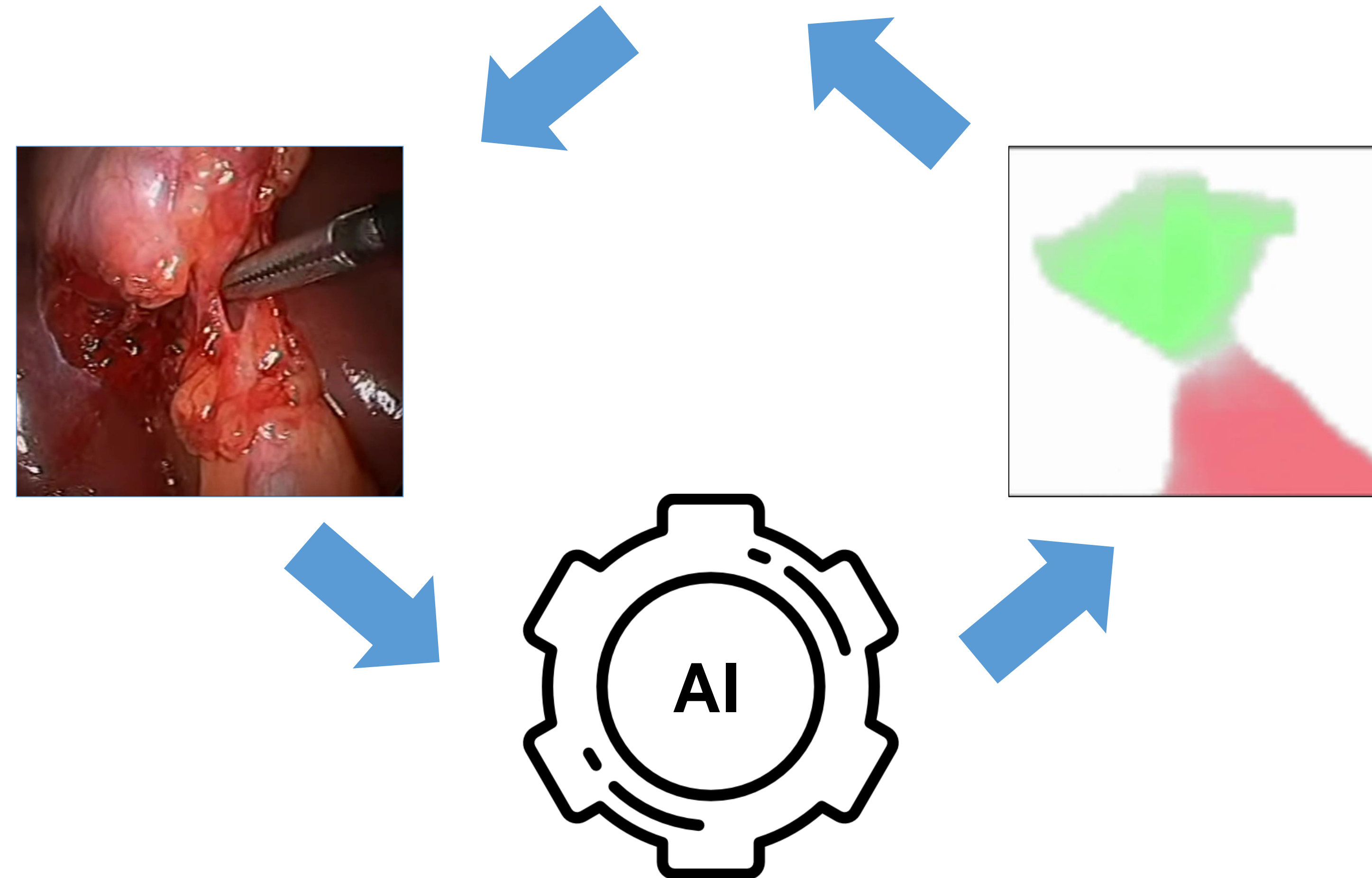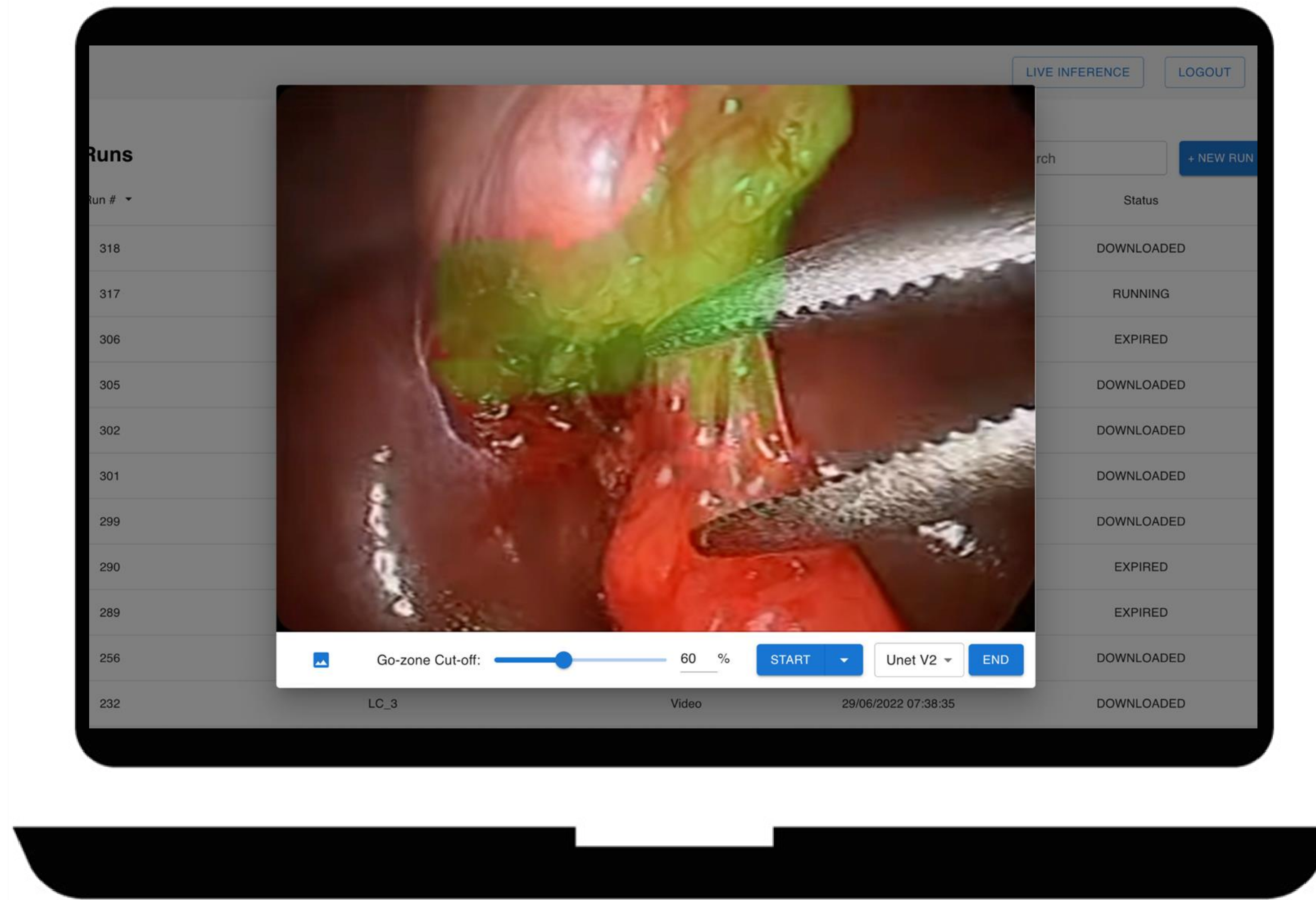
Performance

The platform achieves a framerate of **59 fps** and a latency of **0.1s** under optimal network conditions
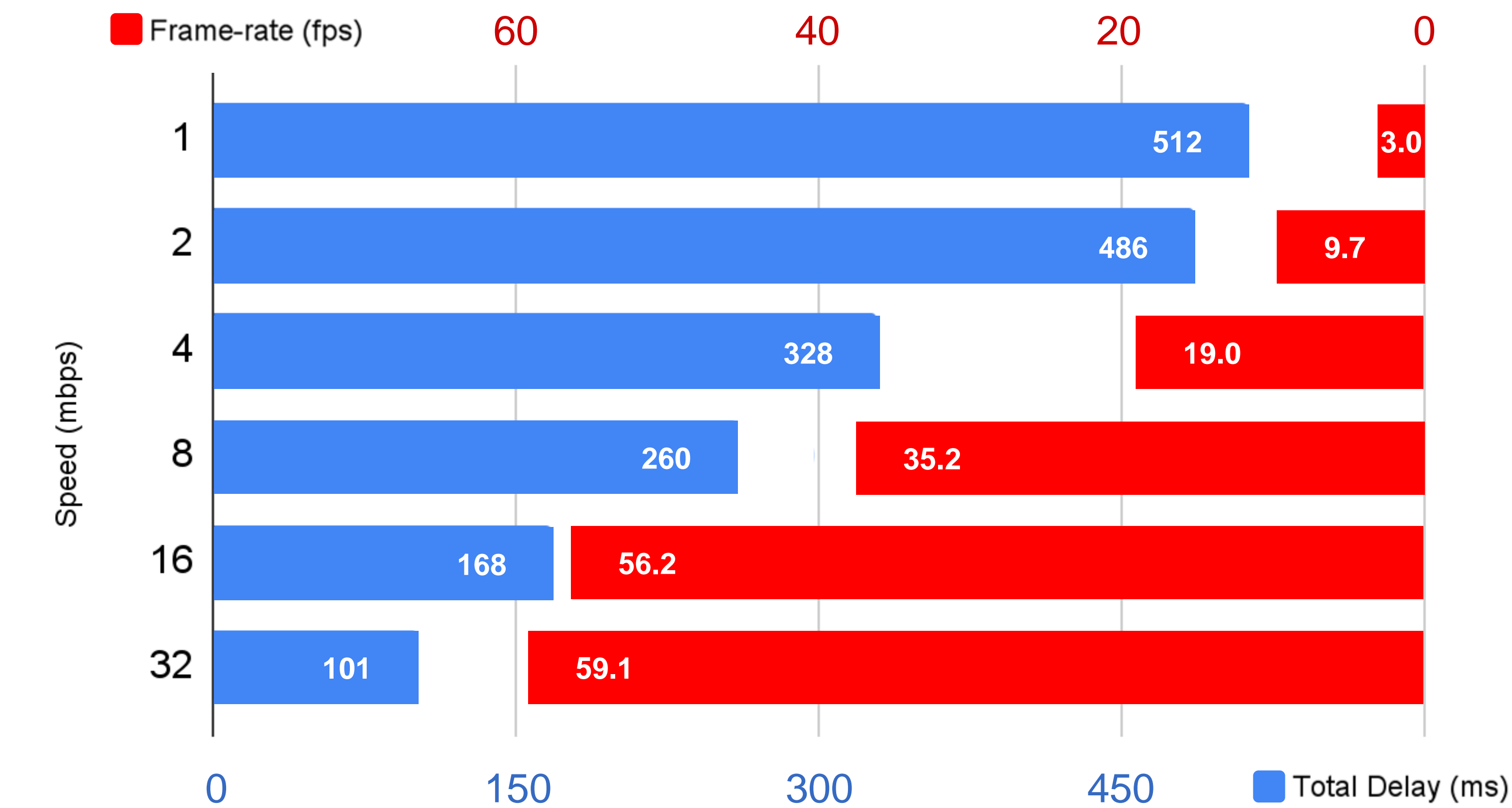
- On the lowest tested speed of 1mbps, the platform was able to run at 3fps under an average delay of 512ms

Conclusion

- Our platform showcases early success on live video streams and holds future promise for accessible training in remote communities

- Future Directions
  - Improve efficiency by reducing redundant predictions
  - Reduce latency by migrating the service to cloud