



Data Driven Education and Athletics Outreach

Progress - Q4-1Y/5Y

McGyver Clark
Affiliate Professor
Brigham Young University

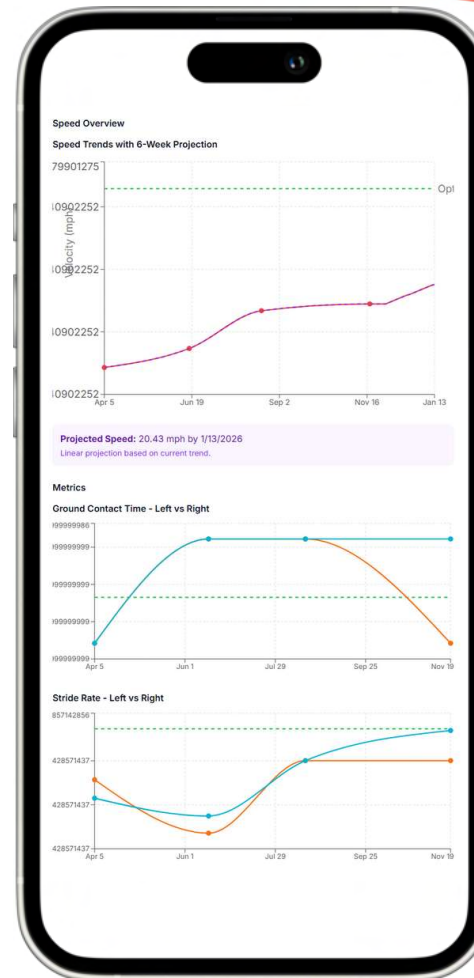
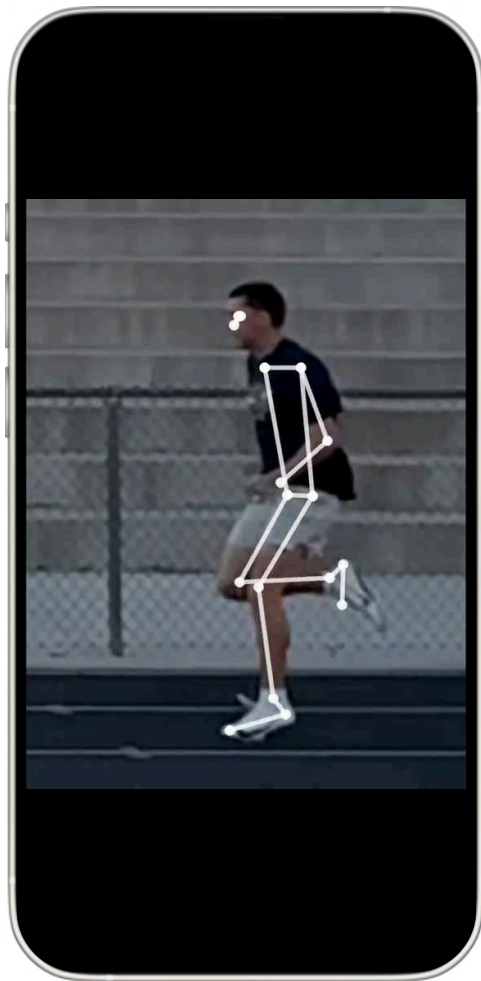


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App Engineering Team



Davin Thompson



Creed Thompson



Luke Grundvig



Ty Oustrich



Chris Kuchin

Data Engineering Team

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Nathan Brimhall



Zarek Proffitt



Mark Bryant



Erik Bryant

Pole Vault



Marcus Thayer



Aaron Thayer



Bradley
Greenhalgh

Outreach Program



Jacey Farmer



McKenna Pouwer



McGyver Clark



John Hedengren

App Engineering

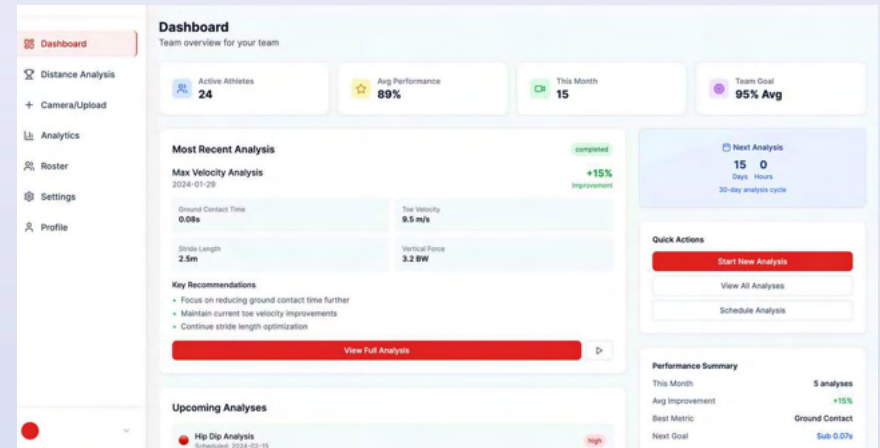
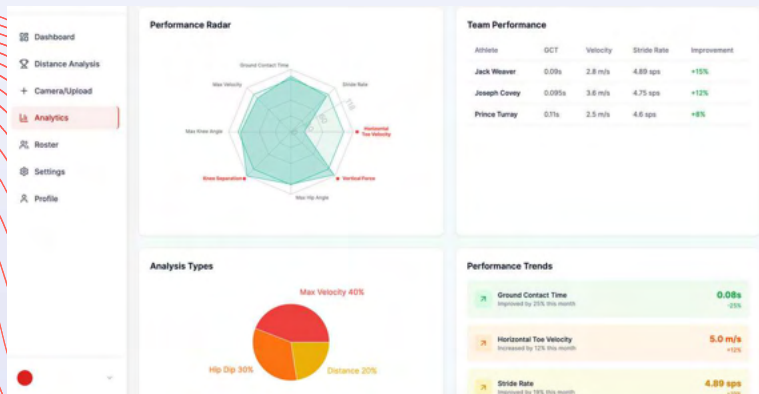
Davin
Creed
Ty
Luke

Accomplishments

- POC Frontend
- Learned tools: React, Tailwind, Vite, Firebase, Flask
- Constructing API
- Created Time Series and Group Data
- Better understanding and quantified recommendations
- Well on their way to creating the fully functional app

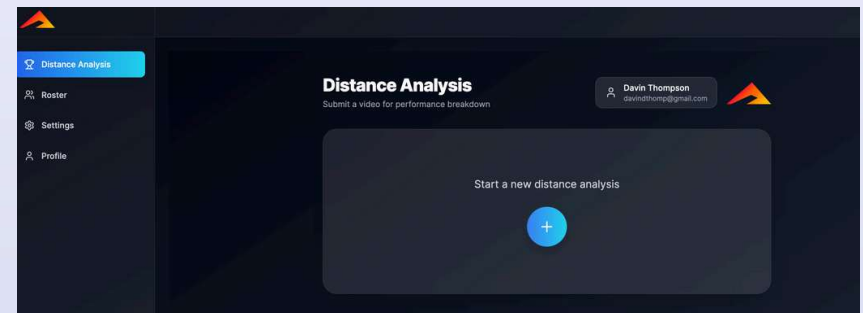
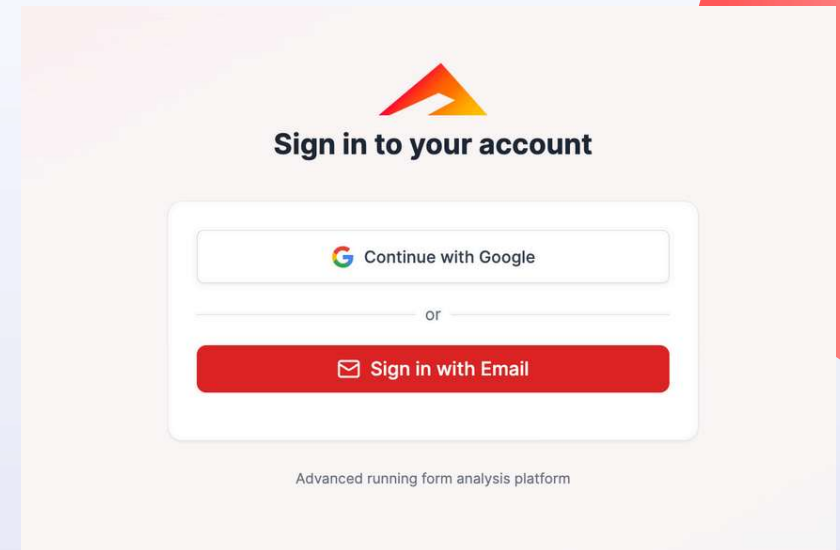
Frontend Developments

- React:
 - Faster development thanks to reusable components
 - Better performance with efficient rendering
 - Easier to scale and extend the product over time
- Vite
 - Faster development and better performance because of optimized production builds



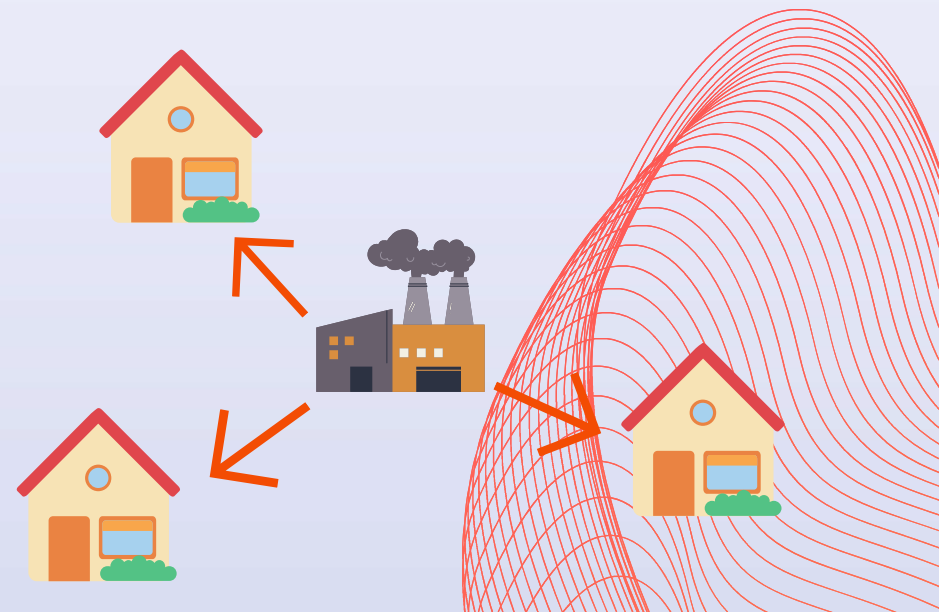
Frontend Developments

- Firebase
 - Authentication, storage, and hosting out of the box
- Flask
 - Lightweight and easy to extend for custom APIs



Constructing API

- Isolated Apps
 - Separate code for each app
 - Slower development
 - Less flexibility
- Central API
 - Single processor for analysis
 - Similar code written once
 - More flexible



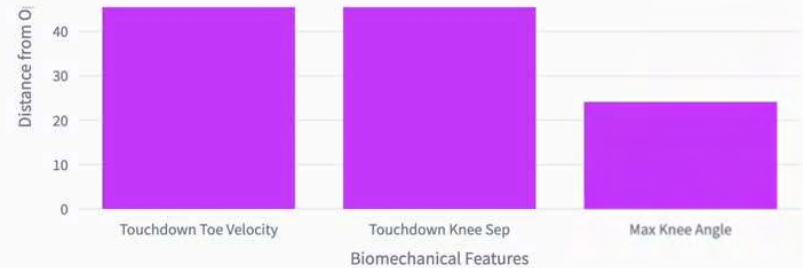
Better Data

Time Series and Group Data

- Interpreting Data and applying it to real-life scenarios
- Using data across multiple analyses to show improvements



- provide quantified and predictable information



#1 Priority: Touchdown Toe Velocity (Score: 20.690)

Current Average Distance from Optimal: 73.6% Priority Level: High

Treatment Effect: 0.281

Improvement Needed: +73.6%

Predicted Improvement: +0.281 mph

I

High Priority: 73.6% improvement needed - significant focus area

#2 Priority: Touchdown Knee Sep (Score: 6.020)

#3 Priority: Max Knee Angle (Score: 0.626)



LEARNED TOOLS

- React
- Tailwind
- Vite
- Firebase
- Flask
- Postgres
- Docker

App Engineering Roadmap

Completed

Streamlined Code



Organized and cleaner codebase

User Interface



A cleaner UI using React

Database Schema



New database schema using PostgreSQL

In Progress...

Fully Functional API



API ready to be plugged in to each analysis type

Deployed App



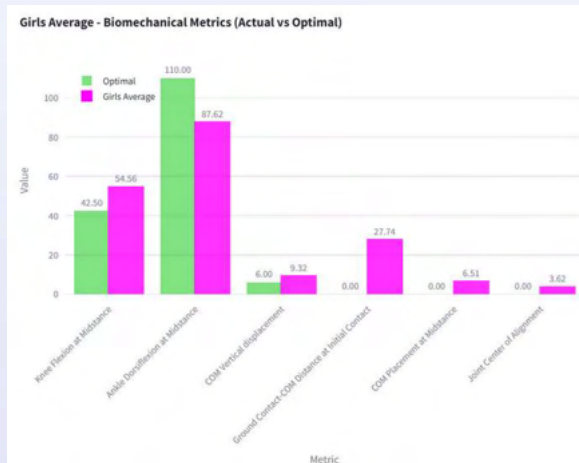
Fully connected app ready for public use

Sprint & Distance Analysis

**Nathan
Zarek**

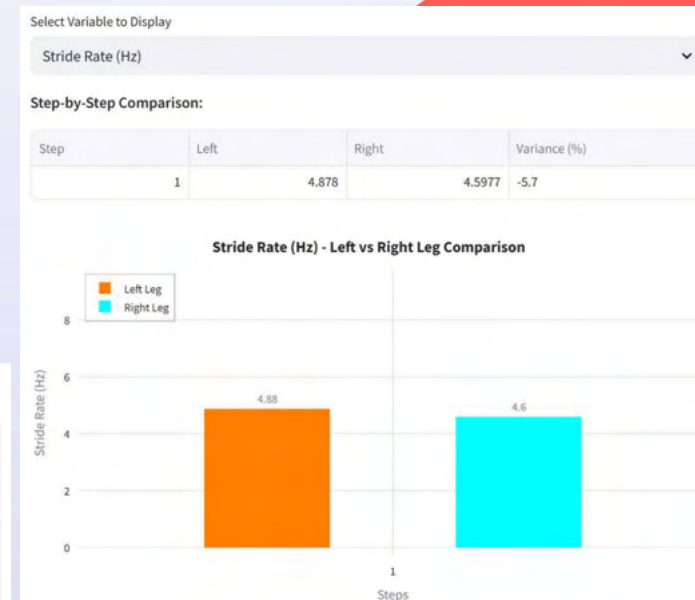
DISTANCE AND SPRINT ANALYSIS

- **Data display** for all 11 distance metrics
- Distance step detection
- **Team stats**
- **Animated videos** for 4 sprint features
- **Personalized feedback**
- New display to review indices
- **Using actively** in outreach visits



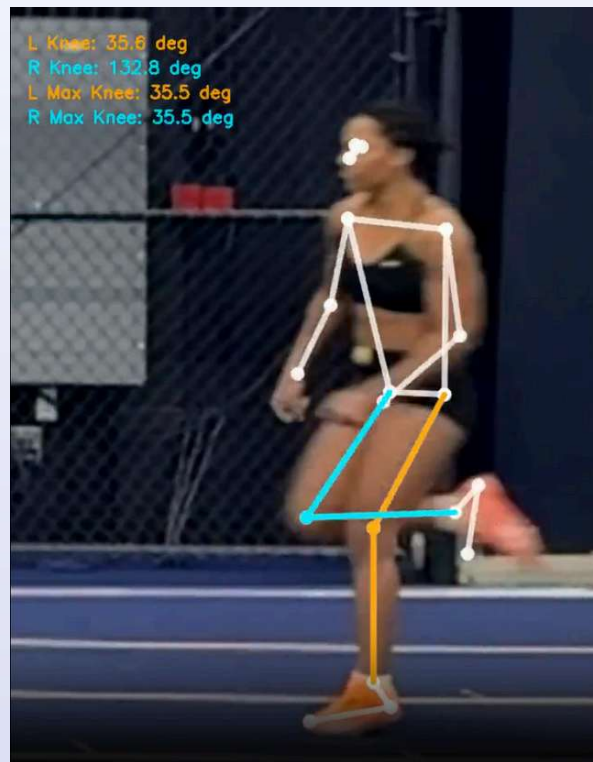
Girls Average

Metric	Actual	Optimal	Difference
Knee Flexion at Midstance	54.56	42.5	12.06
Ankle Dorsiflexion at Midstance	87.62	110	-22.38
COM Vertical displacement	9.32	6	3.32
Ground Contact-COM Distance at Initial Contact	27.74	0	27.74
COM Placement at Midstance	6.51	0	6.51
Joint Center of Alignment	3.62	0	3.62



DISTANCE AND SPRINT ANALYSIS

- **Data display** for all 11 distance metrics
- Distance step detection
- **Team stats**
- **Animated videos** for 4 sprint features
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- New display to review indices
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Overall this is a great analysis. Great job. You have a great group of athletes. Here is some feedback.

I would summarize your team into 2 groups with three outliers.

Group 1 - Knee Distance at Touchdown/ Takeoff Knee Angle

Athletes:

1. Cambria Hasler
2. Jayden Jesse
3. Josh Taylor
4. Kali Dahl
5. Kawaii King
6. Mariane Barber
7. Maria Alvarado
8. Sami Oblad
9. Tate Walker
10. Page Rasmussen

Analysis: These athletes are full extending their legs at takeoff. This will increase GCT and will make them late to recovery. You can see this by how their recovery knees are behind their ground knee.

Recommendation: During Bounds and straight leg drills, focus on controlling the knee joint to not extend fully. To change these drills into a more "spring leg" motion. The reason for this is that the time it takes to extend the knee all the way does not justify the negligible added force it produces. This simple change will convert to significant returns in increased velocity.

Distance & Sprint Analysis Roadmap

Completed

Feature Videos



Create videos illustrating all features

App Display



Incorporate feature videos into app

Display Data



Visualizations, user averages, team averages

In Progress...

Injury Prevention



Add suggested exercises to reduce injury and improve efficiency

Step Detection Model



Automate detection of key frames with model

Throws

Nathan

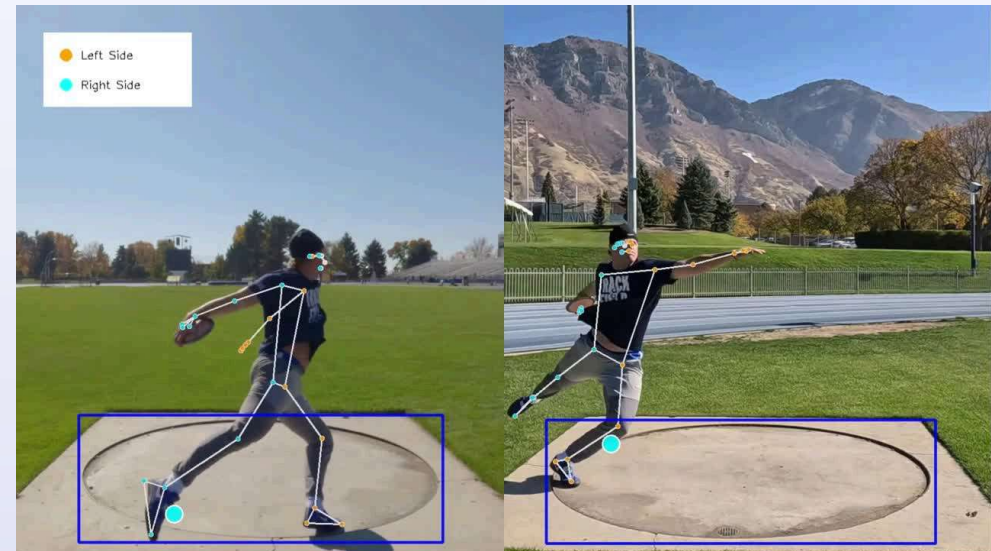
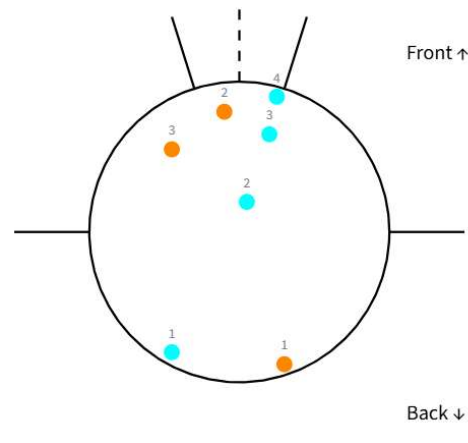
Zarek

Erik

Mark

GOLDEN STANDARD

- Identified **7 new features** to measure
- **Feature animations** and **data collection**
- **Machine learning models** for
 - ring detection
 - step detection
 - tracking discus
 - statistical and data analysis



CURRENT PROGRESS

- Video recording **obstacles**
- **Syncing** back and side view
- **Roboflow** model
- Significant updates to Streamlit throws display

Throw Analysis

New Analysis 25_11_28_1 25_11_26_5 25_11_26_4 25_11_26_3 25_11_26_2 25_11_26_1 25_11_20_2

Analysis: 25_11_28_1

Video Analysis

Select video to display:

Event Toe Markers



Mark Touchdown and Takeoff Events

Previous Event

Current Frame: 0

Next Event

← 30

← 10

← 1

30 →

10 →

1 →



Marked Event Frames

Left Foot

Touchdown: []

Takeoff: []

Right Foot

Touchdown: []

Takeoff: []

Manual Event Marking

Left Foot Controls

Add Touchdown

Remove Touchdown

Add Takeoff

Remove Takeoff

Clear All Left

Right Foot Controls

Add Touchdown

Remove Touchdown

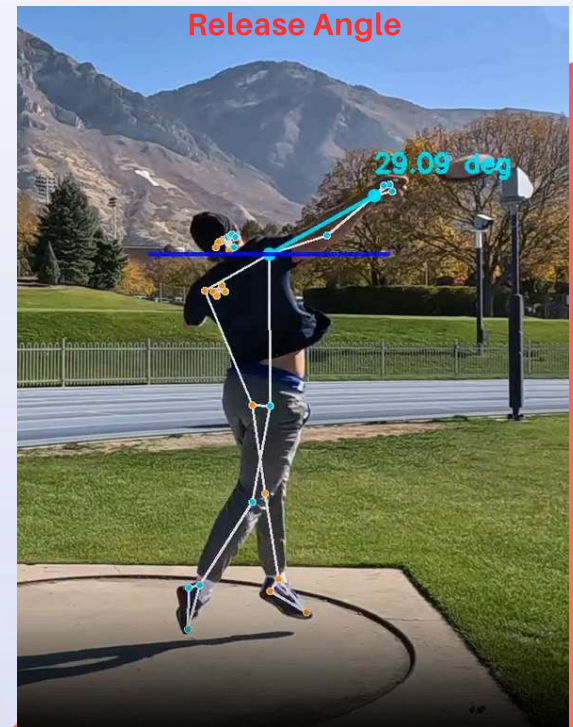
Add Takeoff

Remove Takeoff

Clear All Right

WHAT WE'VE LEARNED

- Identified **7 additional features**---analytical thinking
- **Streamlit** and experience from distance and sprints
- **Machine learning** algorithms to use
 - Roboflow to **annotate** and **create models**
- Onboarding new team members
 - **Python**
 - **GitHub**
 - **Drawing animations**
 - Application of technical experience



Throws Analysis Roadmap

Completed

Streamlit App Revisions



Revise existing throws app to accommodate future progress

Ring Detection Animation



Build framework for ring detection and proof of concept

In Progress...

Ring and Discus Detection Integration



Finish annotating frames; incorporate model and animation into app

Step Detection Model



Create step detection model for throwing stages as well as for distance and sprints analyses

Data Collection and Display



Measurements display and regression models for statistical analysis

Pole Vault

Marcus
Bradley
Aaron



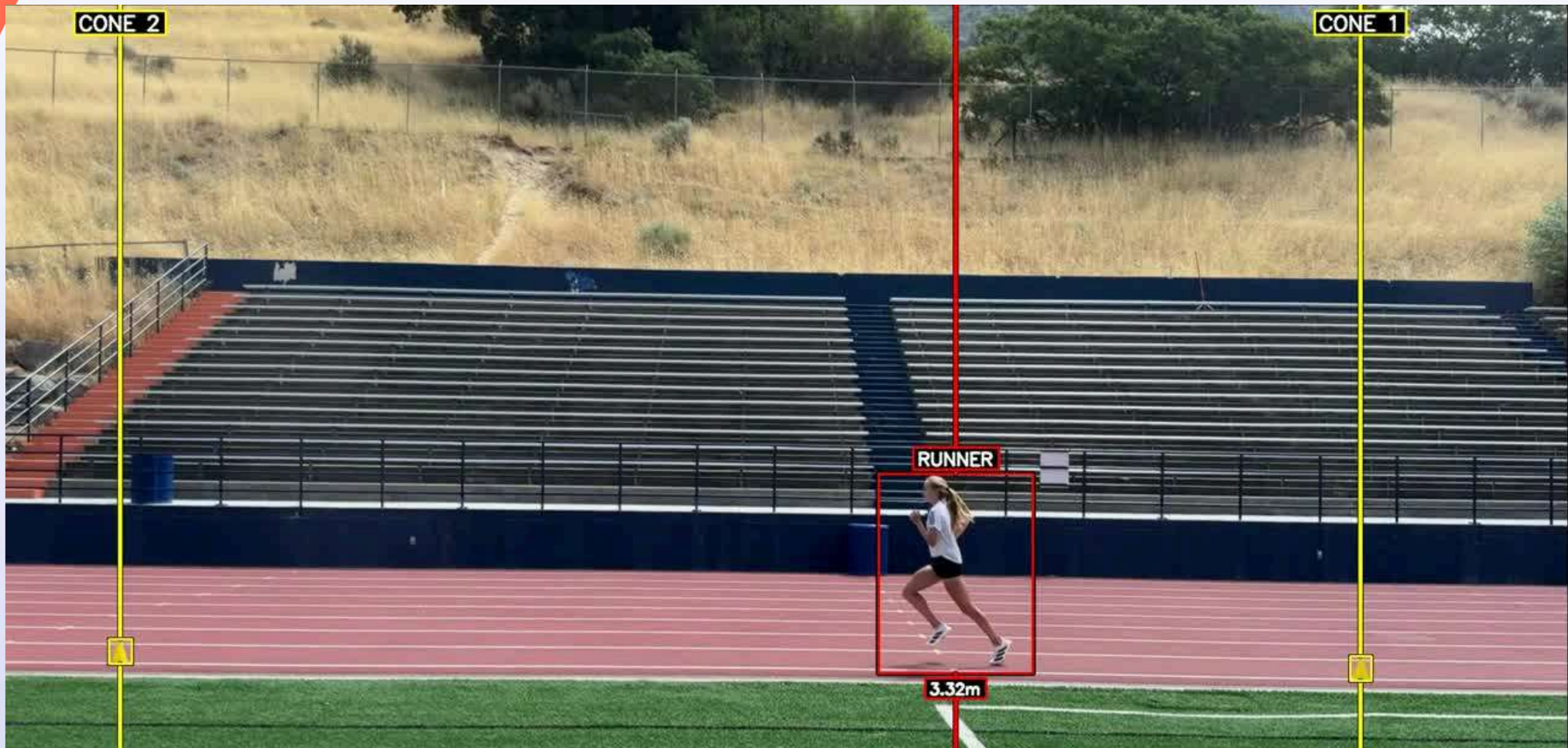
Outline

- Trained and implemented **cone detection** model
- Developed an initial **pole tracking** model
- Adapted **sprint zoom and analysis** for **pole vault** videos
- Created a **proof of concept app** and working towards broader application

Cone Detection w/ Confidence Values



Cone Detection Implemented



Pole Track w/ Partial Model

Created with about $\frac{1}{3}$ of
our full dataset



Pole Vault App POC

Features:

- Hip Droop
- Stride Rate
- Max Pole Bend

Stride rate: 4.21 steps/s (252 spm)
Hip droop (worst 5%): +1.8% of height
Analysis: up to last labeled step.



Pole Vault Analysis Roadmap

Completed

Approach Metrics Engine



Build tools to analyze max pole bend, hip-drop, and stride rate metrics

Preliminary Pole Detection Model



Build a model to track vaulter's pole through their run and jump phases

In Progress...

Pole and Step Detection Integration



Finish annotation; incorporate both models into pipeline, automating max bend and stride rate metrics

Streamlit App



Wrap analyses in a single web app; expand to include more metrics

Data Collection and Display

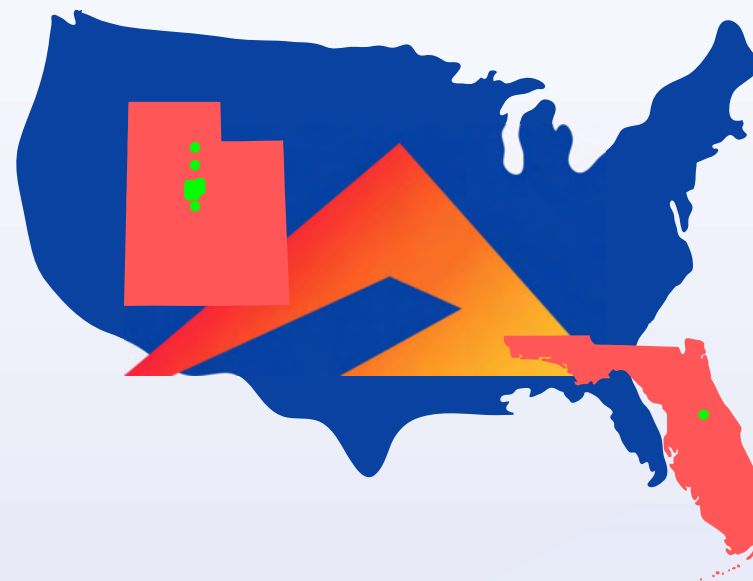
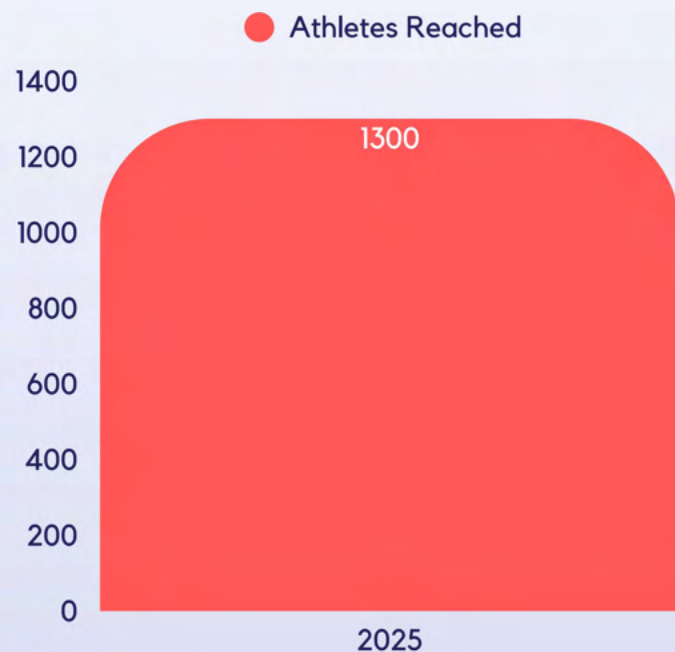


Aggregate vault metrics over time for regression models and injury-risk tracking

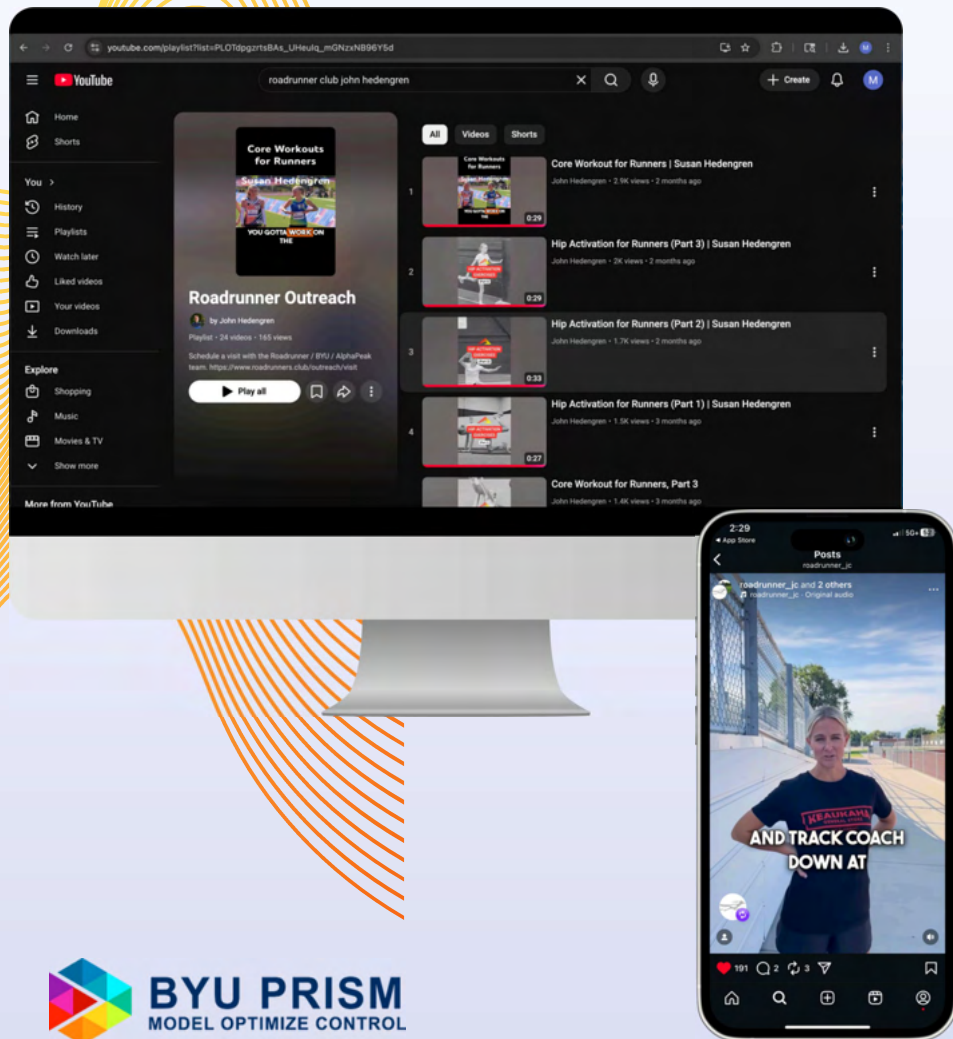
Outreach

McKenna
Jacey

1300+ Athletes Reached

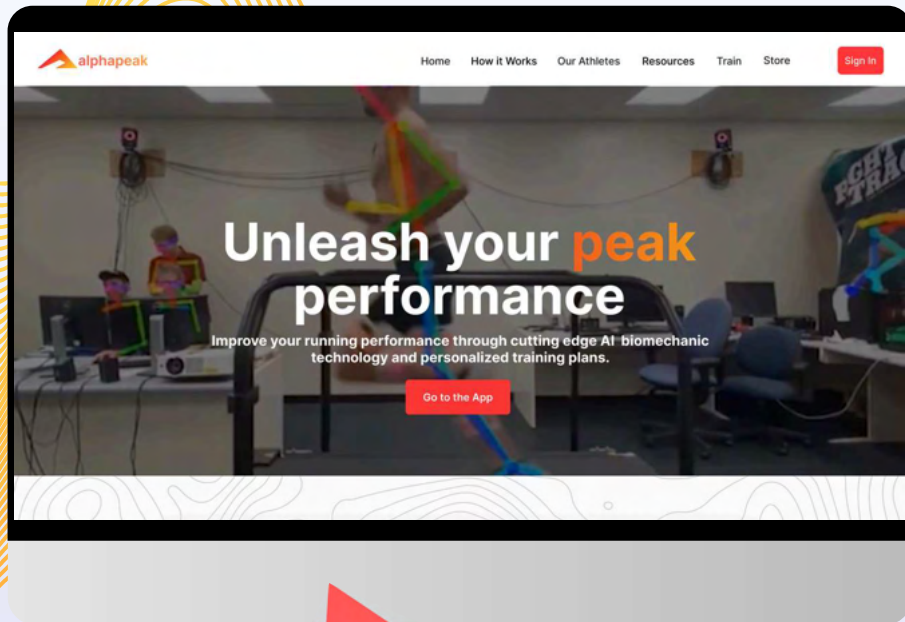


31 visits to 19 Schools



Achievements

- Reached our visits goal for 2025! We have 2 more visits scheduled for this year.
- 2 of the teams visited this year were **collegiate level**.
- **8 schools** have already expressed interest or scheduled for **2026**.
- Expanding online outreach on youtube, website, and instagram through educational/training content.

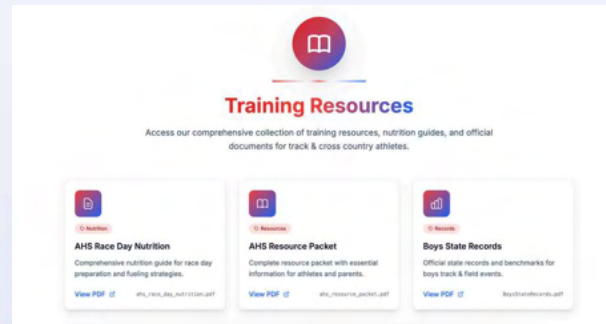
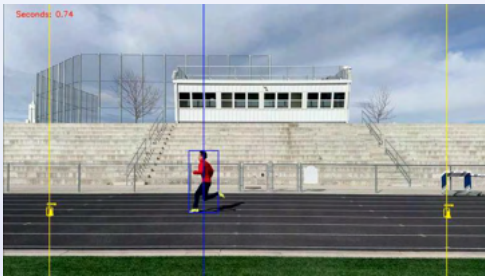


Future Goals

- Continue to schedule visits for next year. (We reached out to **100+ coaches** all across Utah).
- Incorporate the redesign for Alphapeak's platform and training resources so athletes can improve their workouts/training.
- In the process of coordinating our **2nd out of state outreach visit in NY.**



2026 Outreach Vision



Student Visits + **Online Resources** = **Real World Experience**

1300+ Athletes



**Include online
outreach**

**Reach more athletes
and help more BYU
students**

Student Progress McGyver

STUDENT PROGRESSION

Creating Novel Solutions

Modifying Existing Codebase

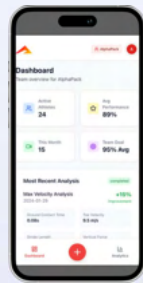
No Coding Experience



FUTURE GOALS



**Stable Versions of
Throws/Polevault**



**Create App with
generalized
analysis factory**



**Continue to improve
the efficiency of
outreach visits**



**Expand resource
library and build
into platform**

STUDENT OUTCOMES



Learn end to end how to create AI Apps



Apply machine learning for usable data



Present technical data to non-technical audience



QUESTIONS?

