Creating an Algorithm for Personalized Fitness Programming

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The State of Fitness Programming

Automation & personalization are everywhere.

Ok, almost everywhere.

Most coaches are still writing workouts and long-term fitness plans by hand. The result?

- Most workout plans are not personalized
- True personalized plans are expensive
- Creating fitness plans - general or personalized - is time consuming for trainers and coaches
The Problem

How can we make personalized programming accessible to everyone?

- Use technology to automate the creation and delivery

What does a viable computer-realizable solution look like?

- Remove the reliance on intuition and instinct
- Retain the feeling that a coach wrote the workouts

MATLAB has helped us do all of the above!
The Deep Athletics Team

Founders

• Aaron Adams
  ○ Former US record holder in Olympic Weightlifting
  ○ 10+ years experience programming for both elite athletes and everyday worker-outers

• Dave Erickson
  ○ 20+ years experience in defense/aerospace industry
  ○ Extensive expertise in modeling, simulation, and building complex algorithms
  ○ Every-day worker-outer
The App

First, let's talk about why you're here.

MY GOAL

ENDURANCE
You want to build endurance, and create a better anaerobic engine.

EXPLOSIVE POWER

WEIGHT LOSS

BODY BUILDING

STRENGTH

OVERVIEW

Dynamic Warm-up
Skills Work
- Weighted Bench Dip
- Wide Grip Barbell Bent Row
- Good Morning
Metcon Work
- Alternating Butt Kicks
- Strict Pull Up
Cardio Work
Core Work
- Superman Hold
- Hanging Hollow Bar Hold
- Tuck to Stack
Stretching

LET'S GO!

THE APP
The Deep Athletics Algorithm

What does the Deep Athletics algorithm do?

- Unique daily workouts
- Maintains periodization and progressive overload
- Avoids human-error mistakes
- Accounts for skill level, equipment, injuries and time commitments
- Very specific daily workouts, including
  - Warmup & stretching
  - Skills, metcons, cardio, & core
  - Reps, weights, & times
Inside The Algorithm

Personal Metrics

Layout Training Calendar

Select Daily Exercises

Goals & Time Commitment

Define Movement Frequencies

Calculate Reps, Weights, Distances

Equipment Availability

Select Workout Scheme

Daily Workouts

Exercise Database

Training Goal Database

Workout Style Database
The Implementation Challenge

The inherently "human" nature of the problem presents unusual challenges that MATLAB is well-suited to handle

- Mixture of numerical and text-based variables throughout

- Large exercise database built in Excel spreadsheets
  - Easy for us to read and modify
  - Separate tool built to read and error check before saving as .MAT file for speed

- Significant randomness built into algorithm
MATLAB allows us to integrate testing & analysis into the algorithm.
Once we determined the algorithm was feasible, the next question became how to deliver workouts to individuals.

- Given today’s world, a phone app is the obvious choice

How can the algorithm interface with an app?

- Port the algorithm to an app-centric language
- Use MATLAB Coder to port to C/C++
- Use MATLAB Compiler SDK to build DLL
- Use MATLAB Production Server to host the algorithm
Delivering The Algorithm

- Azure
  - Deep Athletics Algorithm Compiled to .NET DLL
  - .NET Wrapper

- Heroku
  - User Database
  - Send & Receive Data to Algorithm .NET Interface

- App on User's Phone
  - App Intake Form
  - Daily Workout Display

MATLAB Compiler SDK used to build .NET DLL
My Takeaway on MATLAB

The flexibility of the MATLAB "ecosystem" has significantly simplified our gestation

- Moved from concept development to deployment on the Apple and Android app stores without interruption
- Allows for integrated testing and analysis
- Saved significant money and time
- Remarkable customer support
Thank you for your time & interest!

Deep Athletics - Helping everyday worker-outers realize their Athlete-ness