Technology & Biometrics

Data Machines Corp.

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http://www.datamachines.io

About Data Machines Corp. (DMC)

DMC's Vision: Improve the world by developing technologies to enable data-driven decision making.

DMC's Mission:

- Committed to making computers more capable of beyond-human cognitive performance to ultimately improve human and machine interaction.
- Tackle complex problems in meaningful research with qualified and exceptional world-class data science, engineering, and management staff.
- Specialize in designing, building, and using cloud architectures to engineer and share solutions to difficult problems in data analytics, DevSecOps, machine intelligence / artificial intelligence, and data science.
- Create evaluation, fusion, and performance management systems of varied algorithms pulled from many sources into unified systems.

Our Values: As a small, veteran-owned company, DMC is based around a system of core values including integrity, diversity and inclusion, corporate citizenship and an overall drive to do what is right. We always strive to maintain the highest ethical standards and embrace diversity within our company and community.

Technology Agnostic

We do not lock ourselves or our sponsors into over-investment in any specific technology or product solution. Our core competencies focus on enabling and embracing rapid change to increase effectiveness and lower costs.

Automatic

Creating and managing automatic intelligent behavior is necessary to work elastically and securely at scale. We build systems that adapt to unpredictable change and simplify their intrinsic complexity for operators and users.

Full Stack

Good developers that are familiar with the entire technology stack know how to make better solutions and life easier for those around them. We spend the time required to ensure our engineers are familiar with and trained in all the layers of technology they interact with.

Community

Open software and standards are a foundation for innovative and important work in science, education, and industry. The sponsors who value our services help us contribute to these communities and open collaboration.

DCAA Approved Rates
Facility Clearance Approved
NIST 800-171 Compliant
CMMC 2.0 – in progress

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University and Student Engagement

- Work closely with Penn State University, Applied Research Laboratory
  - Data Science, Data Infrastructure, DevSecOps Engineering
- Sponsor Brigham Young University (BYU) Senior Capstones
  - Senior Capstone Program, DMC Mentors
- Summer Internships at DMC
  - Roles: Business Development, Data Science, Computer Vision, Infrastructure, Cyber Defense
- Judges, guest speakers, scholarship sponsors at regional universities and high schools
  - George Mason University, Penn State University, Bloomsburg University, Villanova University, Norwich University
  - Participate in the Accreditation of Computer Science Curriculum (BU)
  - Loudon Country Public Schools – Special Award for AI/ML

Local(-ish) internship opportunity:

- Work with Emerging Technology Institute (ETI) in Red Springs, NC
  - Skills desired: Computer Vision, Software Development, Databases

Currently Hiring Full Time:

- Clearable Data Scientist (entry/mid-level)
- Clearable Software Engineers (entry/mid-level)
- Cleared DevSecOps (mid-level)

Research, Development, and Community Contributions

Experience working with research partners and academics engineering and enabling massive secure and scalable evaluations with hardware and software solutions. Create shared computer resources, access control resources, ingest data, and run evaluation to enable rapid research.

- **DARPA Media Forensics (MediFor) :** *"Automated assessment of the integrity of an image or video […] in an end-to-end media forensics platform"* – Verification and Validation for 12 Teams. *System under formal transition…* https://www.darpa.mil/program/media-forensics
- **DARPA Data-Driven Discovery of Models (D3M):** *"Automated model discovery systems that enable users with subject matter expertise but no data science background to create empirical models"* - Verification and Validation for 20 Teams. *System under formal transition…* https://www.darpa.mil/program/data-driven-discovery-of-models
- **DARPA Active Social Engineering Defense (ASED):** *"Develop the core technology to enable the capability to automatically identify, disrupt, and investigate social engineering attacks"* - Verification and Validation for 6 Teams. *System under development and testing…* https://www.darpa.mil/program/active-social-engineering-defense

Experience defining standards, leveraging Open Source, and contributing to Open-Source efforts for innovation within government programs. Work with project constraints to introduce innovation and diversity of system.

- NIST Analytics Container Environment (ACE):
  - Video Frame processor at the edge, supports Public Safety Communications Research (PSCR)
  - https://www.nist.gov/itl/iad/mig/analytics-container-environment-ace-reference-framework
- Computer Vision, biometrics, and Machines Learning:
  - https://github.com/datamachines/cuda_tensorflow_opencv
  - CPU, GPU, Jetson, Jupyter
- IEEE 2302-2021
  - IEEE Standard for Intercloud Interoperability and Federation (SIIF)
  - https://standards.ieee.org/ieee/2302/7056/
- NIST SP500-332
  - The NIST Cloud Federation Reference Architecture
  - https://www.nist.gov/publications/nist-cloud-federation-reference-architecture
- OpenStack Scientific SIG
  - Dedicated to representing and advancing the use-cases and needs of research and high-performance computing with OpenStack
  - https://wiki.openstack.org/wiki/Scientific_SIG

Using Open-Source Technology to Upgrade the Army's Next Generation Biometrics Collection (NXGBCC)

Complex System….

… optimized to off-the-shelf hardware tailored for efficient mission execution.

Solution

Because troops deployed around the globe require fast and reliable identity confirmations, we developed the best possible solution that can evolve with technological advances to meet their needs.

Mission Objective

- Upgrade the Army's biometric data collection system
- Build a fully-integrated, seamless, multi-modal biometric identification system
- Create a rugged, robust, fast solution that works in less-than-perfect conditions
- Build comprehensive training materials that are easy to assimilate whether in classroom or real-world settings
- Engineer a consistent user experience across multiple platforms (mobile, static, cloud)

Impact

As a result of our work, the Army has a Next Generation Biometrics Collection System that:

- Allows pre-processing to account for the realities of harsh, deployed environments
- Uses data hashing to generate "neighborhoods" of likely candidates before performing specific searches
- Exhaustively searches biometric databases with state-of-the-art accuracy and fast results
- Gives users confidence in identification matches even if some biometric information is unavailable

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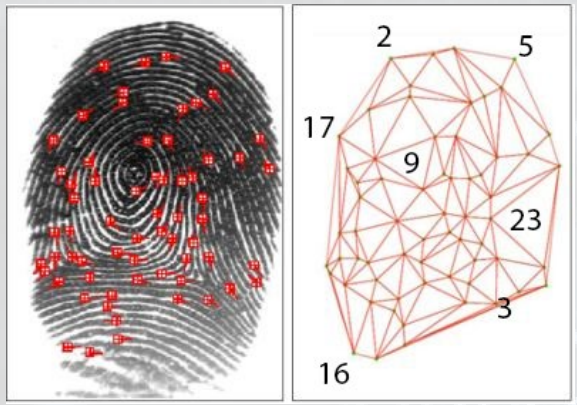
Biometrics – Vectorization & Device/Hardware Agnosticism

RAW Biometrics data for operator convenience

- Not a ready data-type for search -> requires vectorization
- **Vectorization** makes data useful to a search system
  - Available in a different form from the RAW details
  - Lossy but can compare V-to-V (often segments of V)
  - Tailored to each biometric type (fingerprint, …)
- Search Optimizations: Cloud & Geo-colocation, Multimodal



Loosely coupled hardware devices provide RAW biometric data

- Devices are hardware components providing an access API
- USB/Network “Device drivers” with Android/Linux compatibility
- Composability of devices: a new version comes out, upgrade to it

Software abstractions brings devices components together

- REST API: abstract device capabilities into a common set of functions
- Containers: limit service network exposure

Linux/Android: a Mature/Open-Source/STIG-able OS stack

- Cloud-compute-able
- Network stack with support for encryption, mutual TLS, VPNs -> backend for massive vectorization and search

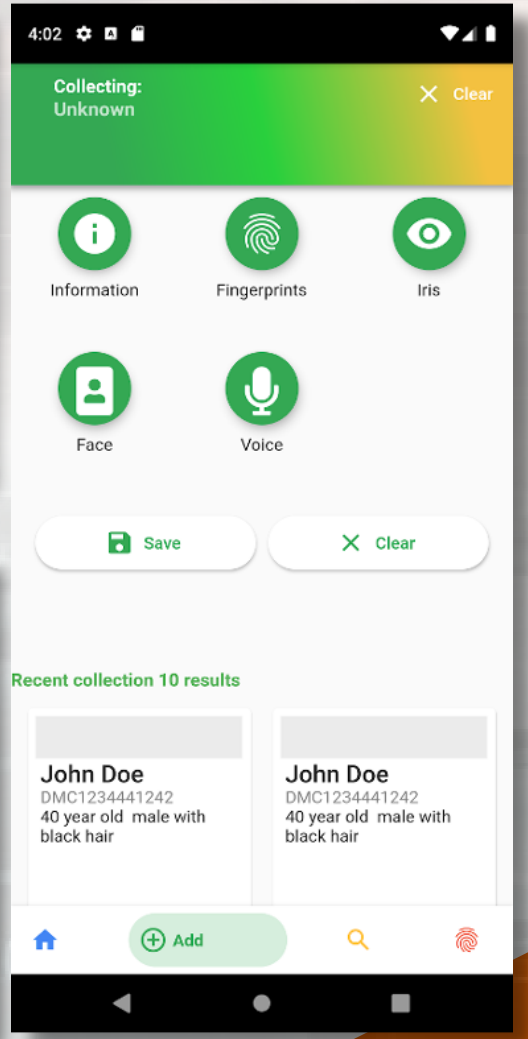
Biometrics – Engineered Solution

DMC's role:

- Build a modern UI across multiple platforms for biometrics collection and processing.
- Engineer portable hardware capable of withstanding the elements
- Swappable, modular and cost-effective hardware stack

What DMC built:

- Mobile and desktop user interface that shares the same look and feel
- Packaged sensors to be used by any mobile devices. We build 3D printed, aluminum and smaller puck version of the mobile stack that includes fingerprint, voice, face, and iris collection capabilities.
- The software can do offline-in-device matching and sync records across a fleet of devices.



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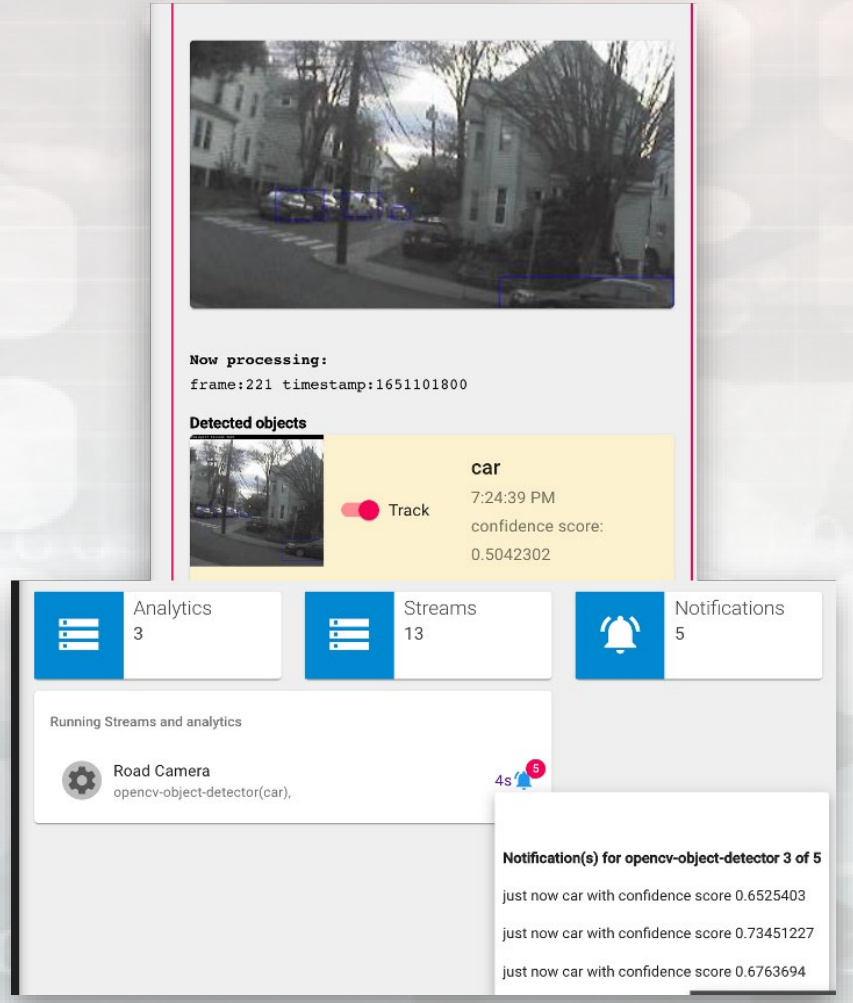
NIST-ACE – Engineered Solution

The goal of NIST-ACE is to improve public safety by utilizing cooperative IOT devices and enabling advanced analytics to them through a common framework.

We developed a **framework** for NIST capable of:

- Making any internet connected camera “smart” by providing capabilities including running analytics, recording events, and sending out notifications.
- Camera video streams can come from drones, CCTVs, traffic systems, and more.
- Framework uses multiple open source analytics in a pluggable fashion.
- Framework delivers video stream(s) to analytic pipelines allowing a huge library of open-source analytics to process. The use cases are endless including:
  - Running analytics from a drone video stream (edge compute w/ GPU)
  - Motion detection, speed detection and object detection
  - Fire, water, and other hazard detection
  - Automatic Target Recognition (ATR)



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Thank you! Please stop by for a demo!

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