

How Simulation will pave the path to AI and Machine Learning

Welcome

Moderator

Denise Nicholson, PhD, CMSP
VP Intelligent Systems
Soar Technology



Mike Macedonia
AVP Research &
Innovation
UCF



Matt Schumacher
Principal
Booz Allen Hamilton



Joanne Barnieu
Dir Learning
Science
ECS



Roger Smith, PhD
Chief Engineer
VT MAK



How Simulation will pave the path to AI and Machine Learning

SoarTech's Mission

To develop human-centered artificial intelligence solutions for the military's toughest problems

United States Service Members

Challenges
 Experts
 Data

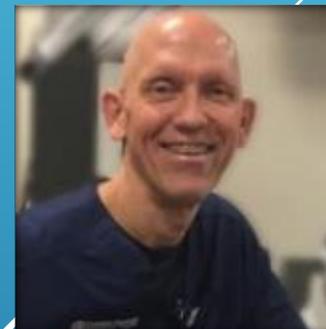
Domains
 Constraints

AI Solutions for Service Members



- SoarTech Internal Research
- Artificial Intelligence Research
- Academia & Industry Research

Dr. Denise Nicholson,
 VP Intelligent Systems



SOARTECH

How Simulation will pave the path to AI and Machine Learning

Our Panel

Moderator
Denise Nicholson, PhD, CMSP
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Mike Macedonia
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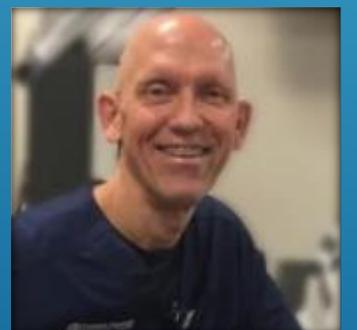
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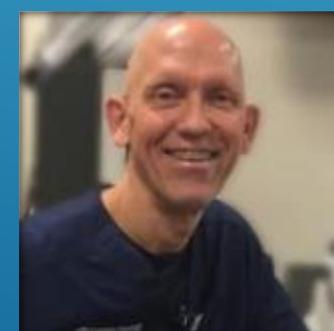
How Simulation will pave the path to AI and Machine Learning

Introduction



Mike Macedonia
UCF

What are some requirements and challenges for AI/ML that can be addressed by simulations?



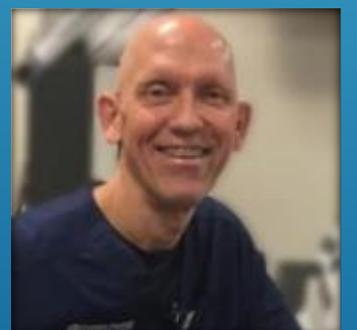
How Simulation will pave the path to AI and Machine Learning

Introduction



Matt Schumacher
Booz Allen Hamilton

Cyber is such an emerging domain...
What should we be thinking about the
role of AI & ML?
Can simulation be part of the solution?



How Simulation will pave the path to AI and Machine Learning

Introduction

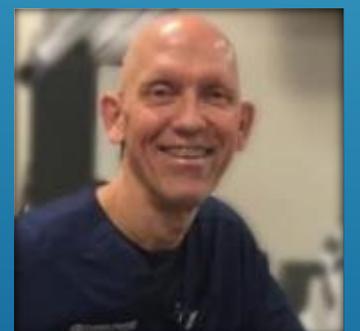


Joanne Barnieu
ECS

Data Data Data...

There is so much data being
generated in LVC training.

What data could be available to
aid AI/ML development and testing?



How Simulation will pave the path to AI and Machine Learning

Introduction

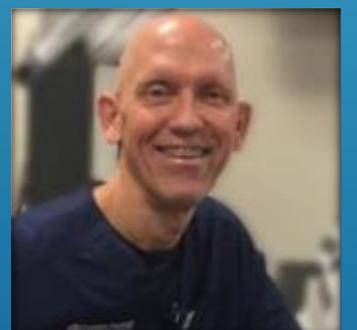


Roger Smith, PhD
MAK

Use Case?

Example of the use of surgical simulation
to train Neural Net...

How does this translate to other domains?



How Simulation will pave the path to AI and Machine Learning

Our Topic

Moderator

Denise Nicholson, PhD, CMSP
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Mike Macedonia
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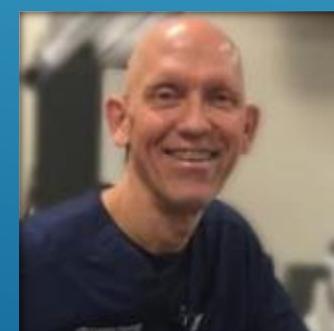
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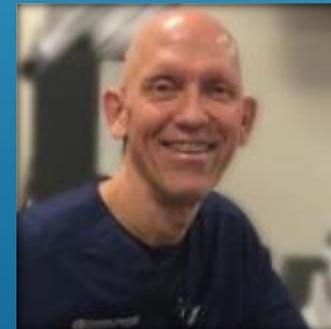
How Simulation will pave the path to AI and Machine Learning

Question



Mike Macedonia
UCF

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Battlefield Uses of Artificial Intelligence Study

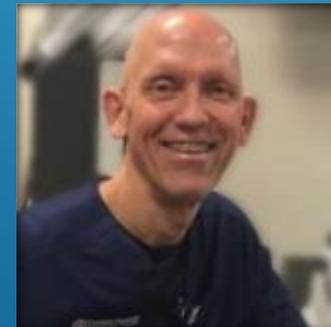
Bottom Line Up Front

- Artificial intelligence (AI) is core to the cognitive revolution
- Optimal use of AI on the battlefield will require new Army way of thinking
 - Continuous collection and curation of data
 - Rapid execution of the “AI Dev-Ops cycle”
 - Cooperation between AI elements of heterogeneous systems
- Conventional DoD processes won’t work for acquisition of AI-enabled systems
 - New approaches are needed

Mike Macedonia

AVP Research & Innovation @ UCF

Army Science Board



How Simulation will pave the path to AI and Machine Learning

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Matt Schumacher
Booz Allen Hamilton

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Booz | Allen | Hamilton*



Matt Schumacher

TSIS 2020

A Cyber Perspective on AI and Simulation

JUNE 2020



A PERSPECTIVE ON AI/ML AND SIMULATION

THIS IS AN EMERGING MARKET

- The number of use cases today will grow exponentially as underlying technologies matures
- Governance is an important aspect as the market matures

THIS IS A GAME-CHANGING TECHNOLOGY

- Likely **demand for trusted models will outstrip supply** as well as the enabling data-sets to create the models
- As a result, *crawl, walk, run* approach is important when implementing AI/ML to any level of complexity

WHAT IS THE GOAL OF AI/ML?

- Reduce complexity
- Increase efficiency
- Increase effectiveness

SIMULATION PROVIDES SIGNIFICANT BENEFITS FOR AI/ML TECHNOLOGIES

- Accelerant to solutions
- Makes the developmental economics work



AI/ML AND SIMULATION IN THE CYBER DOMAIN



Use Case: How do you protect and ensure resiliency with **mission critical systems** such as GPS?

- **Attack vectors** continuously evolve requiring a need for continuous vulnerability assessment and testing – AI is an important tool in threat mitigation
- **Simulation** – modeling satellite architectures, components, and attack vectors in order to identify vulnerabilities and validate cyber attacks on systems in space



Use Case: Convergence of cyber effects in an **Information Warfare** environment.

- **AI applications** provides some unique challenges and opportunities for offensive and defensive capabilities
 - Adversary AI in a contested electromagnetic battlespace
 - Detection and identification in a degraded environment (ISR, etc.)
 - Force-multiplier for DCO operations
- **Simulation** creates the test environment to accelerate AI-enabled solutions – critical for decisive advantage



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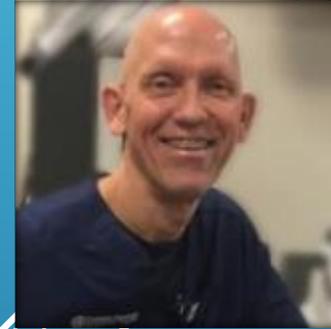


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ENGINEERING & COMPUTER
SIMULATIONS

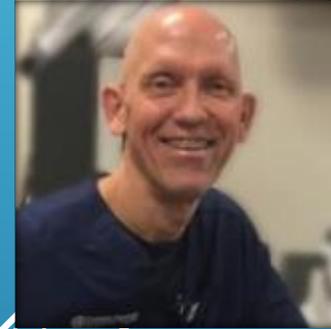


SIMULATIONS AI & MACHINE LEARNING A LEARNING SCIENCE PERSPECTIVE

JOANNE BARNIEU, MS

DIRECTOR OF LEARNING SCIENCE

ENGINEERING & COMPUTER SIMULATIONS



How Simulation will pave the path to AI and Machine Learning

SIMULATION DATA

Military simulation data exists due to the recognized advantages of simulation versus live training (Barnieu, et al., 2018) such as:

- Large # of students within a controlled environment
- Increase the number of practice & feedback opportunities
- Varied scenarios including rare & high stress situations, and allowed to make life critical errors



How Simulation will pave the path to AI and Machine Learning

FIDELITY OF DATA

For maximum learning impact, Military training simulations are driven to be as realistic as possible by having:

- High fidelity virtual environments
- Augmented reality
- Haptics



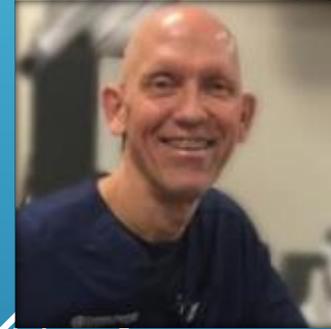
Advantage for machine learning



How Simulation will pave the path to AI and Machine Learning

TRAINING: ADAPTIVE CURRICULUM

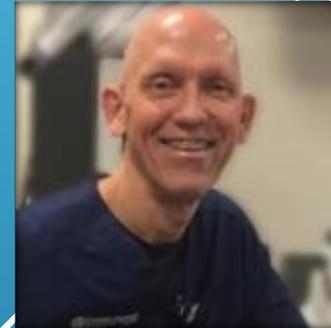
- Adaptive training provides trainees with training content that is personalized
- This can occur without instructor intervention through the use of AI /ML automated recommenders



How Simulation will pave the path to AI and Machine Learning

ASSESSMENT: RATER BIAS REDUCTION

- During live assessments, rater bias or rater error can exist
- Assessments designed with ML and AI could recognize optimal performance without bias



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Roger Smith, PhD
MAK

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AI / Deep Learning as an Assessment Tool for Live Training

Roger Smith, PhD

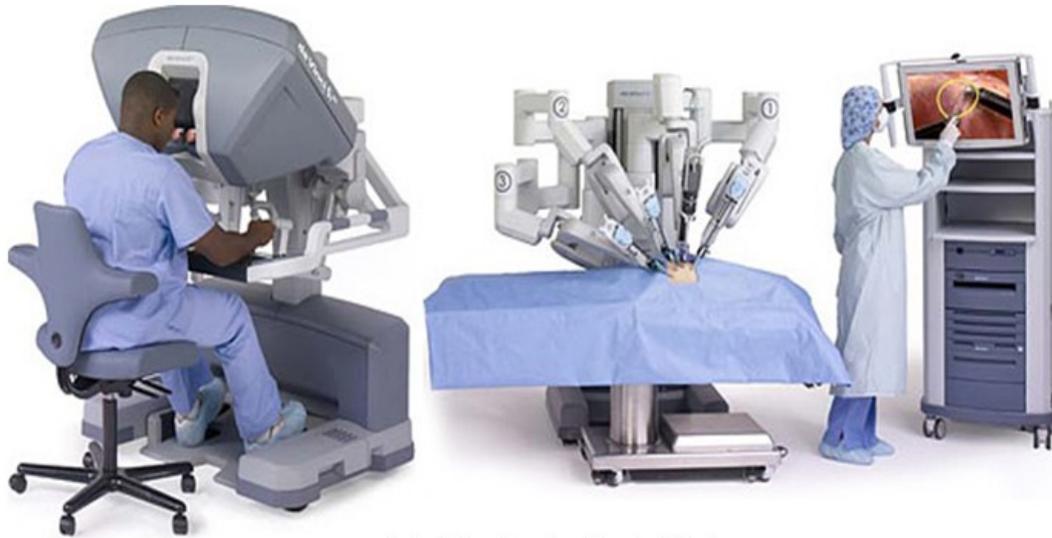


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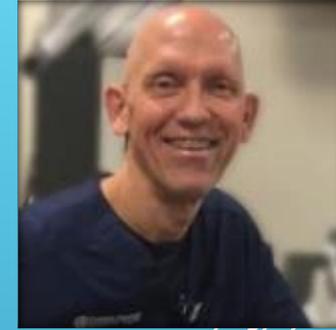
Live Military Training



Live Surgical Training



Intuitive Surgical's da Vinci



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Assessment of Surgical Skills

1. Simulator



2. Dry-lab



3. Wet-lab

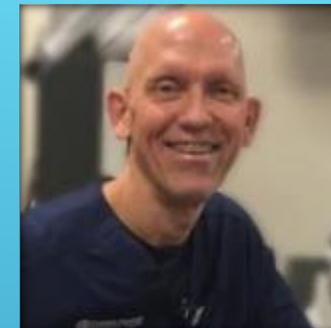


Characteristics of the Video Images

Few Objects
Good Contrast
Identical Angle & Lighting

Few Objects
Variable Contrast
Similar Angle & Lighting

Many Objects
Terrible Contrast
Different Angle & Lighting



Performance Videos from Simulation



Source Data:

254 videos
HD quality
150 secs (avg)
Human Expert Scores

Actions:

10 sec Clips
Down Sample
Data Wrangle (23 steps)

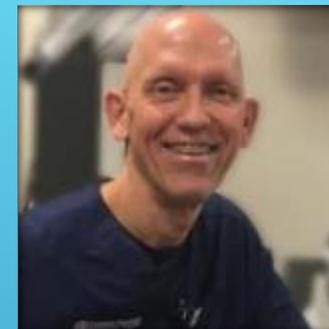
Classification:

Subject is an:

- Expert,
- Intermediate,
- Novice

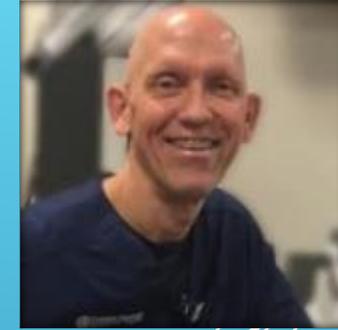
Google AutoML:

2,333 Clips
80/20 Train/Test



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Interest in DL Evaluation of Video



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Follow up questions

Thank you!

Denise.Nicholson@soartech.com

