Man vs Machine
Optimized Development Processes
with Artificial Intelligence

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Why AI?

- **more power**
  - harder problems
  - complex automatization

- **more flexibility**
  - wider range
  - quicker reactions

- **more efficiency**
  - computational resources
  - future advances...
  - Quantum Machine Learning?
What does AI do?

Problem

- What is 5+2?
- Is this a bird or is it a plane?
- What is the optimal production plan for my smart factory?

Solution

- 7
- Definitely a bird.
- Start with item #27 on machine C, then...
What does AI do?

- What is 5+2?
- Is this a bird or is it a plane?
- What is the optimal production plan for my smart factory?

Problem

- Input
- Algorithm

Environment

- Execution

Solution

- Definitely a bird.
- Start with item #27 on machine C, then…
What does AI do?
What does AI do?

Diagram:
- Goal
- Human
  - Input
  - Problem
  - Algorithm
  - Execution
  - Solution
  - Environment
  - Computer

Diagram labels:
- Goal
- Input
- Problem
- Algorithm
- Execution
- Solution
- Environment
- Computer

Diagram flows:
- Goal to Human
- Human to Input
- Input to Problem
- Problem to Algorithm
- Algorithm to Execution
- Execution to Solution
- Solution to Environment
- Environment to Computer
- Computer to Goal

Success Stories

- Playing Go and similar games
- Face and image recognition
- Natural language processing
New Businesses

- sharing economy
- suggestion systems
- autonomous vehicles
- smart factories?
The Major Challenges

- Multi-Agent Coordination
- Mission Criticality
- Migration and Change
Multi-Agent Coordination

Component
  Subcomponent
  Subcomponent
  Subcomponent

Component
  Subcomponent
  Subcomponent

Component
  Subcomponent
  Subcomponent

Component
  Subcomponent
  Subcomponent

Component
  Subcomponent
  Subcomponent
Multi-Agent Coordination
Multi-Agent Coordination

Component
- Subcomponent
  - AI Subcomponent
  - Subcomponent

Goal

Component
- AI Subcomponent
- Subcomponent

Goal

Component
- AI Subcomponent
- Subcomponent

Goal
Multi-Agent Coordination

Multi-Agent System

AI Component

AI Subcomponent

Subcomponent

Component

Goal

Goal

Goal

Subcomponent

Component

AI Subcomponent

Component
Multi-Agent Coordination

Problems
- communication complexity
- conflicting goals
- emergent behavior

Approaches
- dynamic groups
- reward assignment
- teacher/student

Guideline
Systems are open, not closed.
Mission Criticality

target workstation → routing algorithm → route to follow
target workstation → routing algorithm → route to follow → quality test
Mission Criticality

target workstation → AI routing algorithm → route to follow
Mission Criticality

target workstation → AI routing algorithm → route to follow

route to follow

route to follow

route to follow
Mission Criticality

target workstation

AI routing algorithm

route to follow
route to follow
route to follow

quality test
Mission Criticality

- target workstation
- AI routing algorithm
- route to follow
- route to follow
- route to follow
- Al quality test
Systems are made out of processes, not results.
Migration and Change

Component
- Subcomponent 1
- Subcomponent 2
- Subcomponent 3

Component
- Subcomponent 1
- Subcomponent 4

Software developer
Migration and Change

Component
- Subcomponent 1
- Subcomponent 2
- Subcomponent 3

Component
- Subcomponent 1
  - Subcomponent 4

AI
Migration and Change

Component
- Subcomponent 1
- Subcomponent 2
- Subcomponent 3

History
- Subcomponent 2
- Subcomponent 3

Component
- Subcomponent 1
- Subcomponent 4

AI
Problems
- tracing back changes
- gradual updates

Approaches
- transparent AI
- transfer learning

Guideline
System development is eternal, never finished.
The Major Challenges

- Multi-Agent Coordination
  Systems are open, not closed.

- Mission Criticality
  Systems are made out of processes, not results.

- Migration and Change
  System development is eternal, never finished.
Paradigm Shift

▶ Multi-Agent Coordination

- Systems are open, not closed.
- AI needs to be communicative.

▶ Mission Criticality

- Systems are made out of processes, not results.
- Use AI to check AI.

▶ Migration and Change

- System development is eternal, never finished.
- Distill reasoning from AI decisions.
The interactions between humans and AI need to change fundamentally.

The concepts are there but we need the tools!
Thank You!

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