# RECITATION: DECOMPOSING REQUIREMENTS

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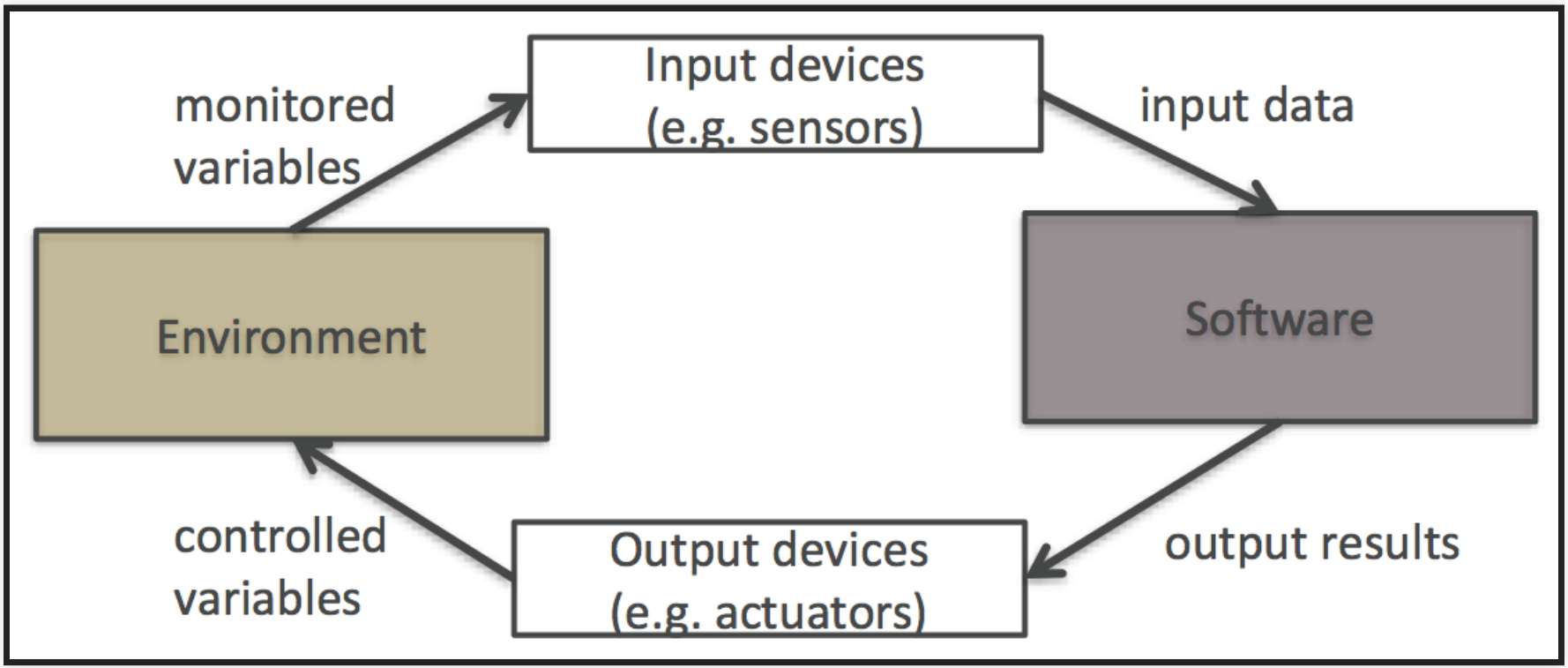
Slides adopted from Eunsuk Kang

# THE ROLE OF REQUIREMENTS ENGINEERING

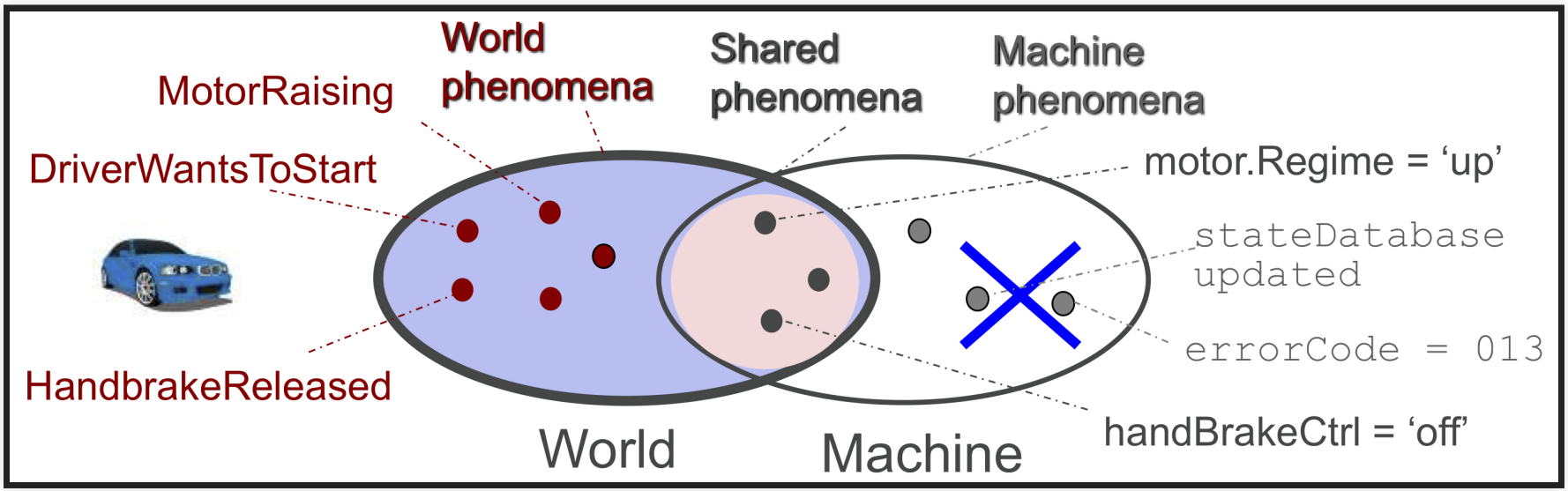
- Requirements engineering essential to understand risks and mistake mitigation
- Understand
    - user interactions
    - safety requirements
    - security and privacy requirements
    - fairness requirements
    - possible feedback loops

# MACHINE VS WORLD



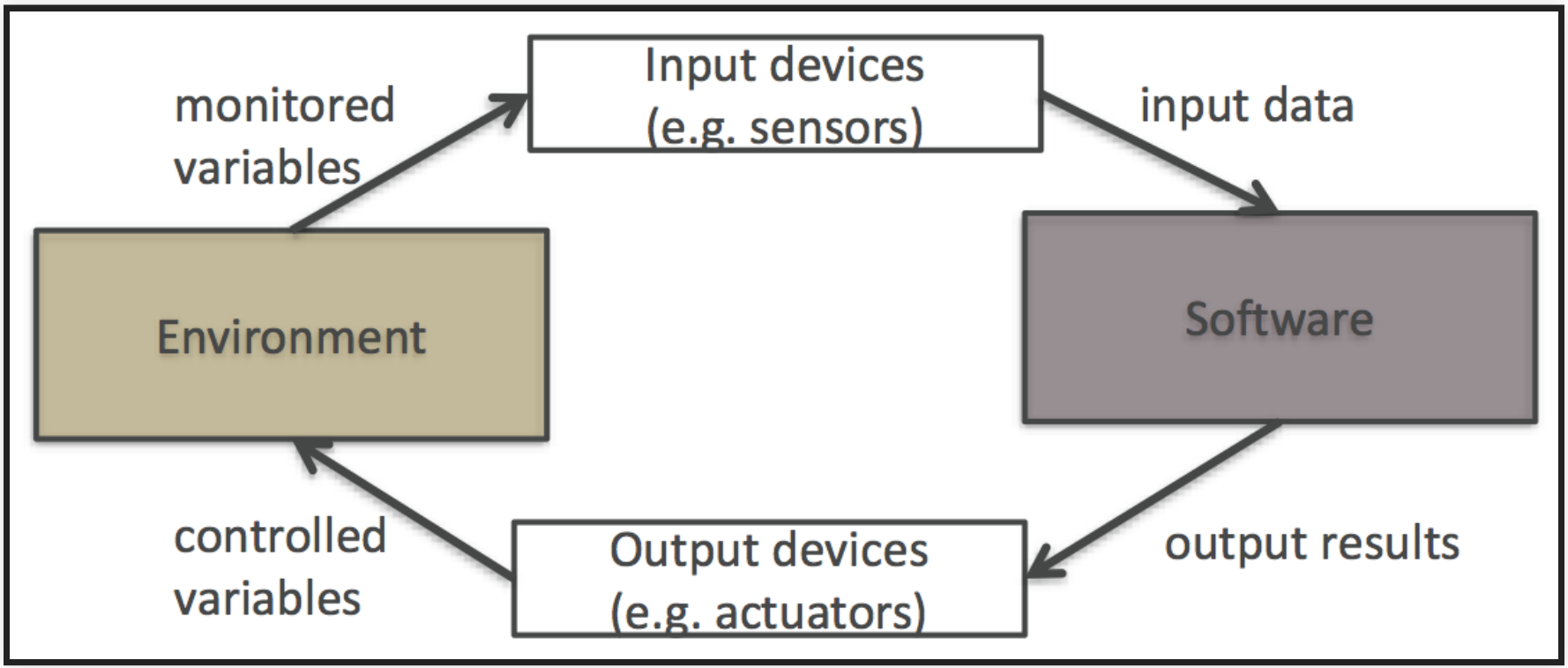

- No software lives in vacuum; every system is deployed as part of the world
- A requirement describes a desired state of the world (i.e., environment)
- Machine (software) is *created* to manipulate the environment into this state

# SHARED PHENOMENA



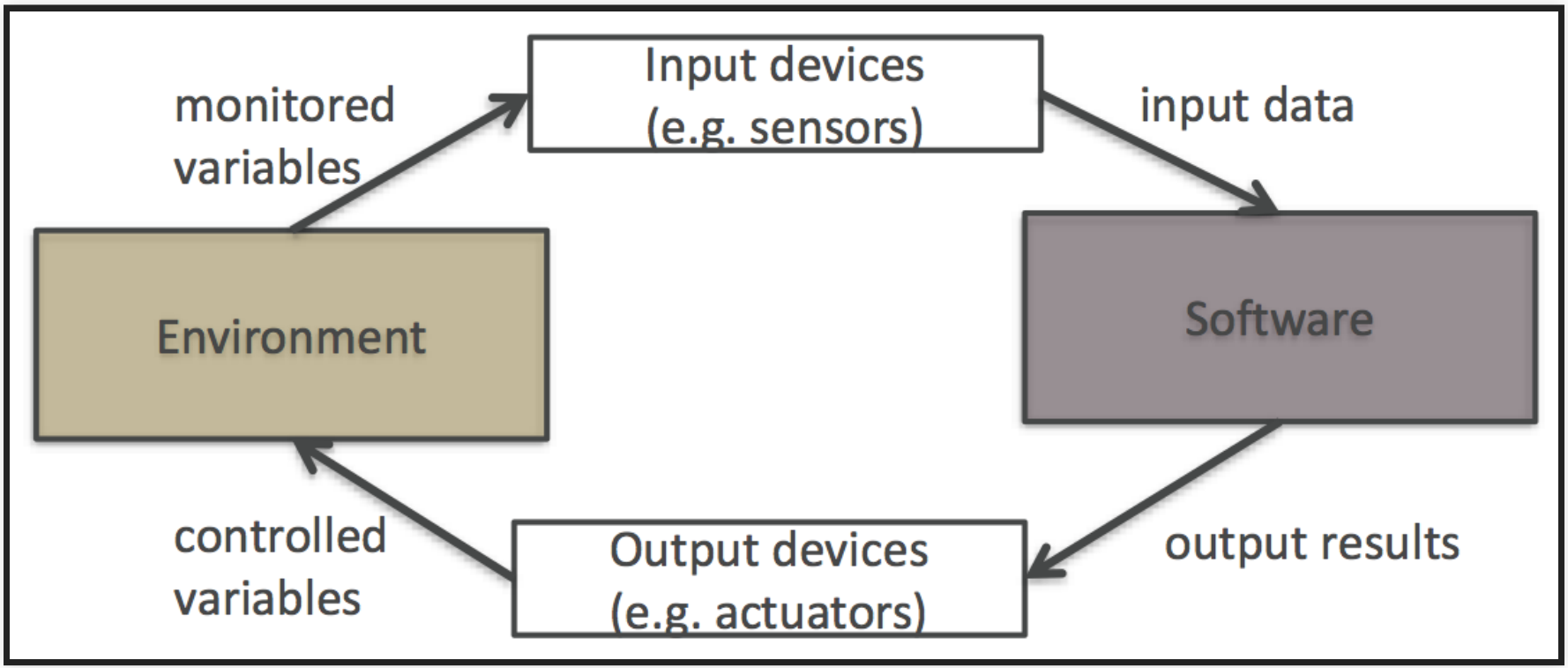

- Shared phenomena: Interface between the world & machine (actions, events, dataflow, etc.,)
- Requirements (REQ) are expressed only in terms of world phenomena
- Assumptions (ENV) are expressed in terms of world & shared phenomena
- Specifications (SPEC) are expressed in terms of machine & shared phenomena

# TASK 1: MACHINE VS WORLD




**Task: In groups, identify Requirements, Assumptions and Specifications for (1) Amazon product recommendations, (2) predictive policing, (3) screening applicants for Masters program**

# WHAT COULD GO WRONG?

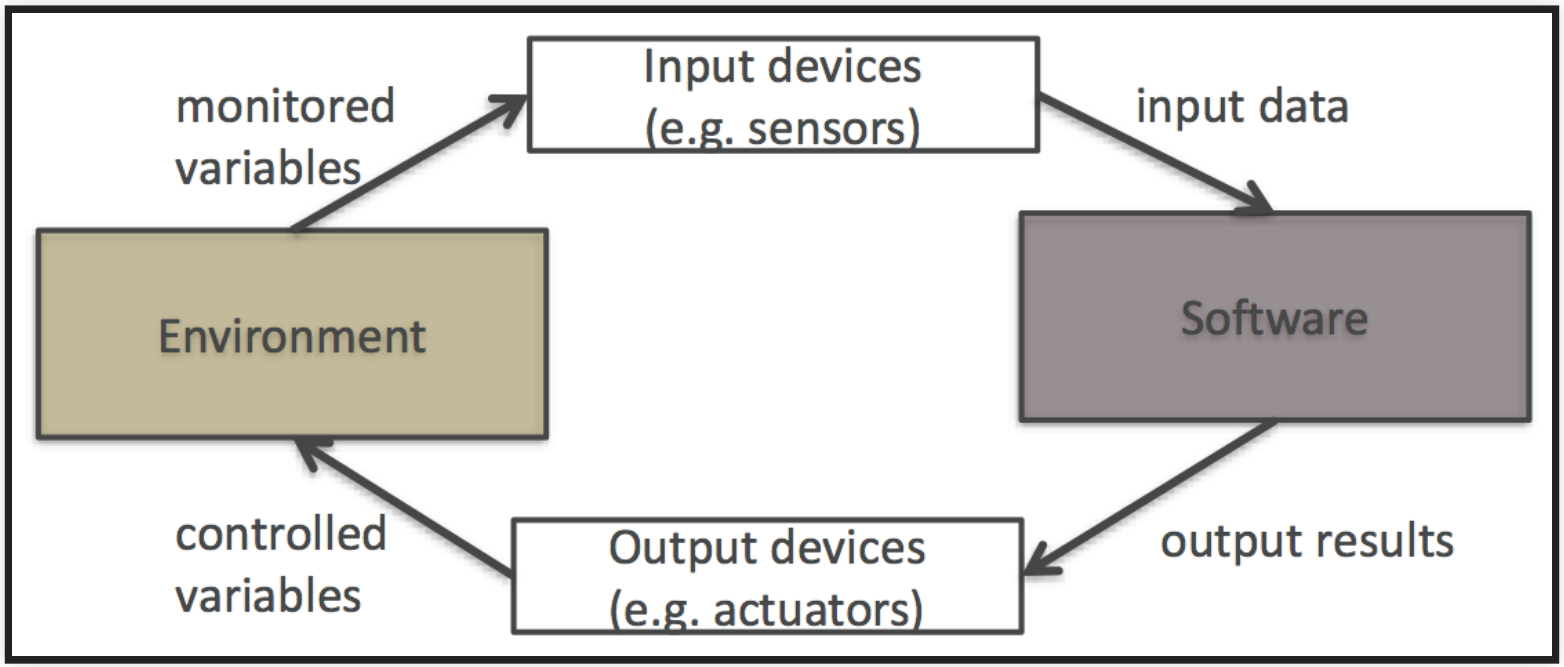



- Missing/incorrect environmental assumptions (ENV)
- Wrong specification (SPEC)
- Inconsistency in assumptions & spec (ENV ∧ SPEC = False)
- Inconsistency in requirements (REQ = False)

# NON-AI EXAMPLE: LUFTHANSA 2904 RUNWAY CRASH

- Reverse thrust (RT): Decelerates plane during landing
- What was required (REQ): RT enabled if and only if plane on the ground
- What was implemented (SPEC): RT enabled if and only if wheel turning
- But: Runway wet + wind, wheels did not turn, pilot overridden by software

# FEEDBACK LOOPS AND ADVERSARIES




- Feedback loops: Behavior of the machine affects the world, which affects inputs to the machine
- Data drift: Behavior of the world changes over time, assumptions no longer valid
- Adversaries: Bad actors deliberately may manipulate inputs, violate environment assumptions

# TASK 2: IDENTIFY POTENTIAL PROBLEMS

- Missing/incorrect environmental assumptions (ENV)
- Wrong specification (SPEC)
- Inconsistency in assumptions & spec (ENV ∧ SPEC = False)
- Inconsistency in requirements (REQ = False)
- Resulting in problems with feedback loops, data drift, adversaries

**Task: In groups, identify examples of problems in (1) Amazon product recommendations, (2) predictive policing, (3) screening applicants for Masters program**