Modeling – models and learning

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Fontys University of Applied Sciences, Hogeschool ICT

MDE-IP
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Lectoraat HTES

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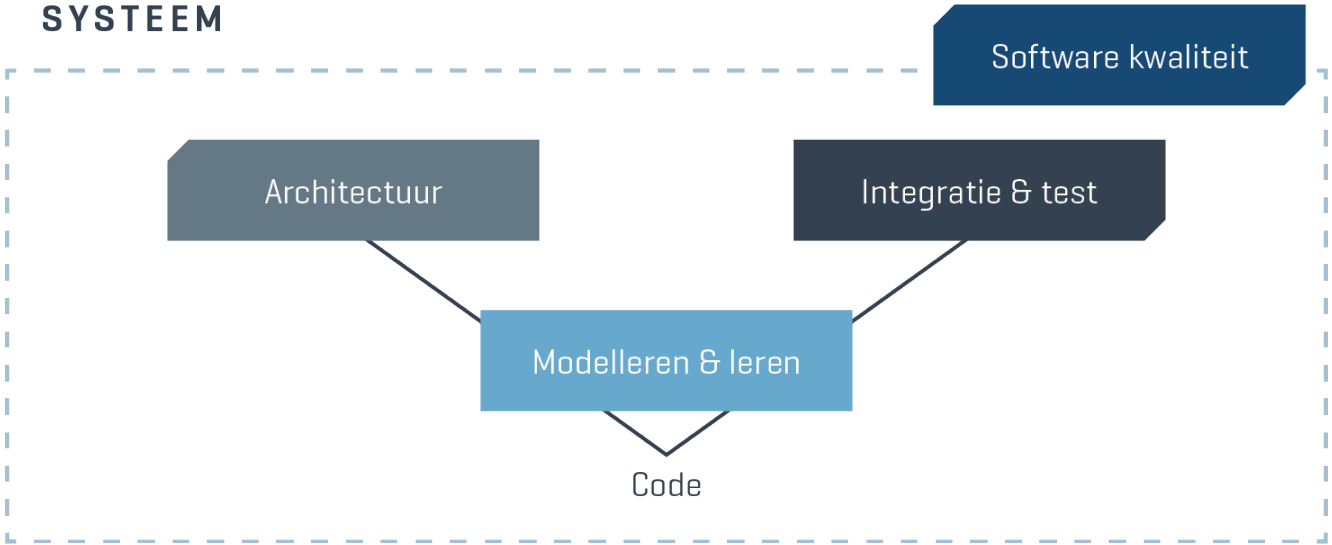
Software development for smart systems: mobile robots & sensor networks



(Punter, 2018)

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Fontys ICT

Eindhoven | Tilburg | companies

Year 1-2 Rachelsmolen R10

Stappegoor

PIE – Partners in Education

Year 3-4

Strijp TQ4/5

PII – Partners in Innovation

Sparc

Partners in Innovation

Research expeditions

1. Sensing the City
2. Data stories for you
3. De Dingen De Baas
4. Learning C2C (Cradle to Coffin)
5. Bildung and Gaming
6. Software 5.0
7. Autonomous Robots in the Wild
8. Human Robot Cooperation (Cobots)
9. High-tec Social Fabric

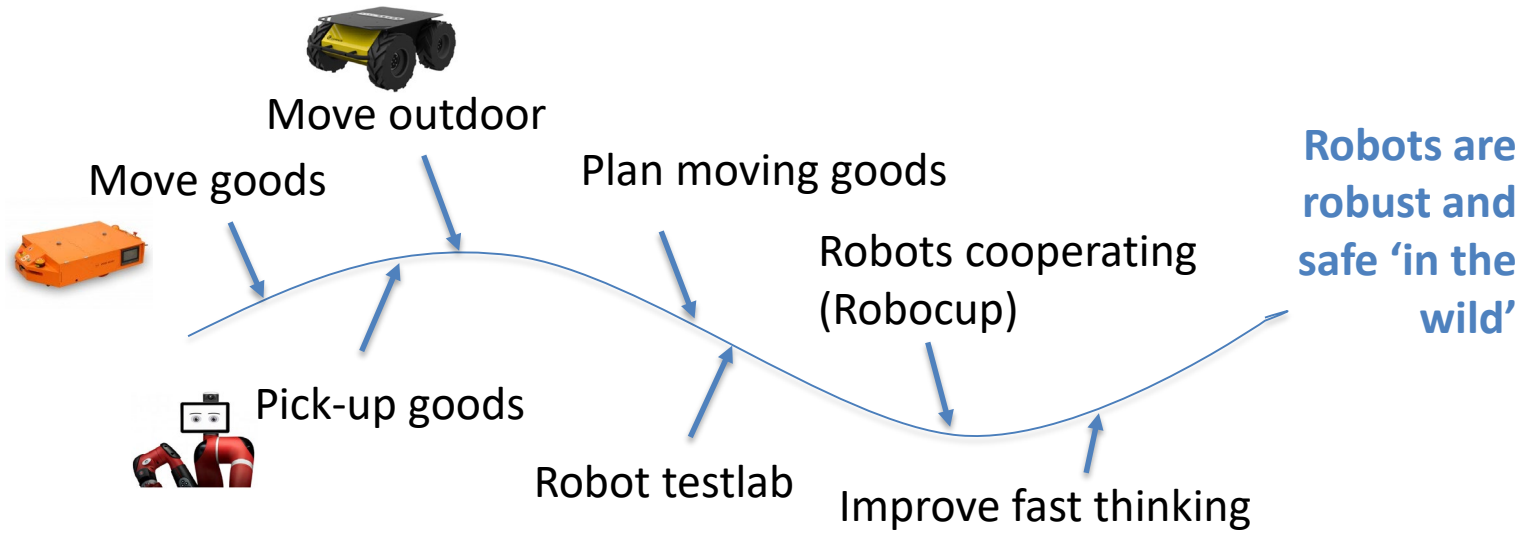
Research project

Research project

IMPACT ON SOCIETY

Research expedition – Autonomous robots i/t wild

- (Mobile) robots, e.g., AGVs, outdoor platforms
- How to define robot behavior? How to make and test robots?



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Modeling Course

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Modeling at Fontys ICT & T

Course: Model Driven Development of Embedded Systems

- Semester 6

- A bit of modelling earlier:
  - Flow charts in Sem1
  - Simple State Machines in Sem2
  - UML in Sem3

- Last year: 65 students in Sem6 at TQ4

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Course: Focus

- Model embedded software application with given requirements
- Interface the model with a given embedded system using handwritten code
- Generate and build code from your model and deploy on the target
- Validate, and if possible verify, that model using a tool

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Course: Form

- Assignments
- Modeling tools
  - Papyrus-RT
  - Dezyne
  - Stateflow (Simulink)
  - IBM Rational Rhapsody
  - … (own choice tool)
- Flexible on tools ➔ modeling is the main objective
- Embedded hardware platform

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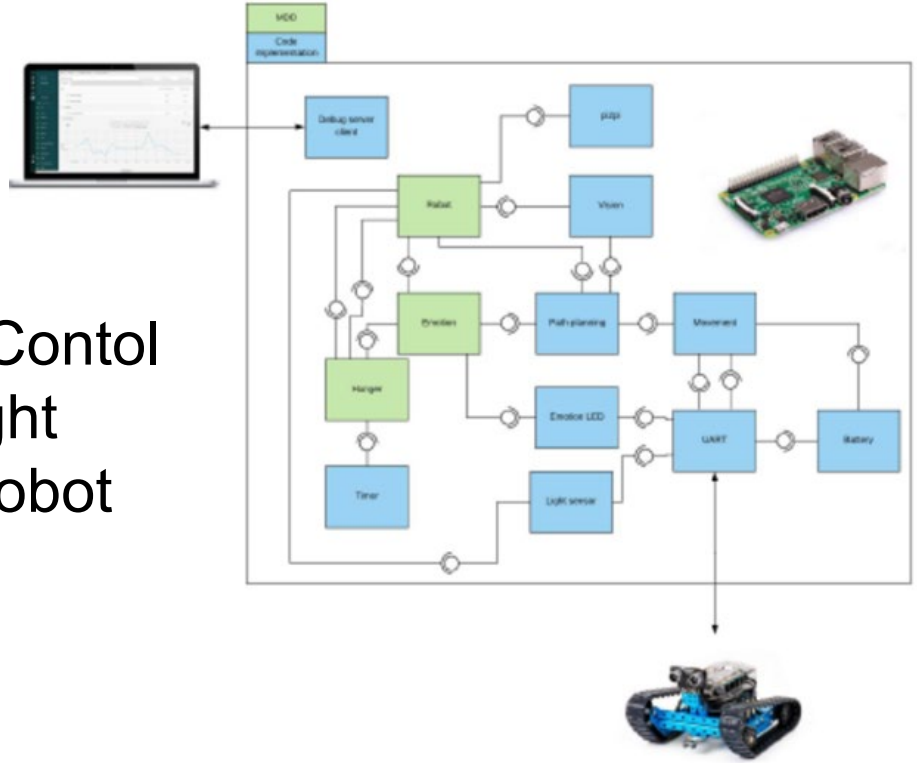
Course: Form



- Elevator Contol
- Traffic Light
- Swarm Robot
- Hexapod
- ...

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Observations

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- Difficult to sell model driven development (as opposed to coding) to students

- Beginning -> 95% resist
- Midterm -> 70% resist
- End -> 40% resist

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Educational challenges

- Requires abstraction
- Requires ability to think in terms of "blocks" (component based design)
- Most students have programming mindset and prefer to stay on that level
- Tools not suitable for HBO (Bachelor) students, i.e. not as simple to use as a compiler
  - steep learning curve for all tools
  - academic tools are complex and instable (e.g. Papyrus-RT)

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Your input is highly valued:

What are your expectations about an HBO student with respect to MDD?

What can we do better?

What might be a first improvement step?

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Feedback

Provide your feedback also via
Be Socrative:
https://b.socrative.com

Choose: student login
Apply password: PUNTER1235

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Modeling Research

“ModelLeren”

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Robot Behavior Modeling

- Zero programming

- Behavior modeling
- Behavior learning

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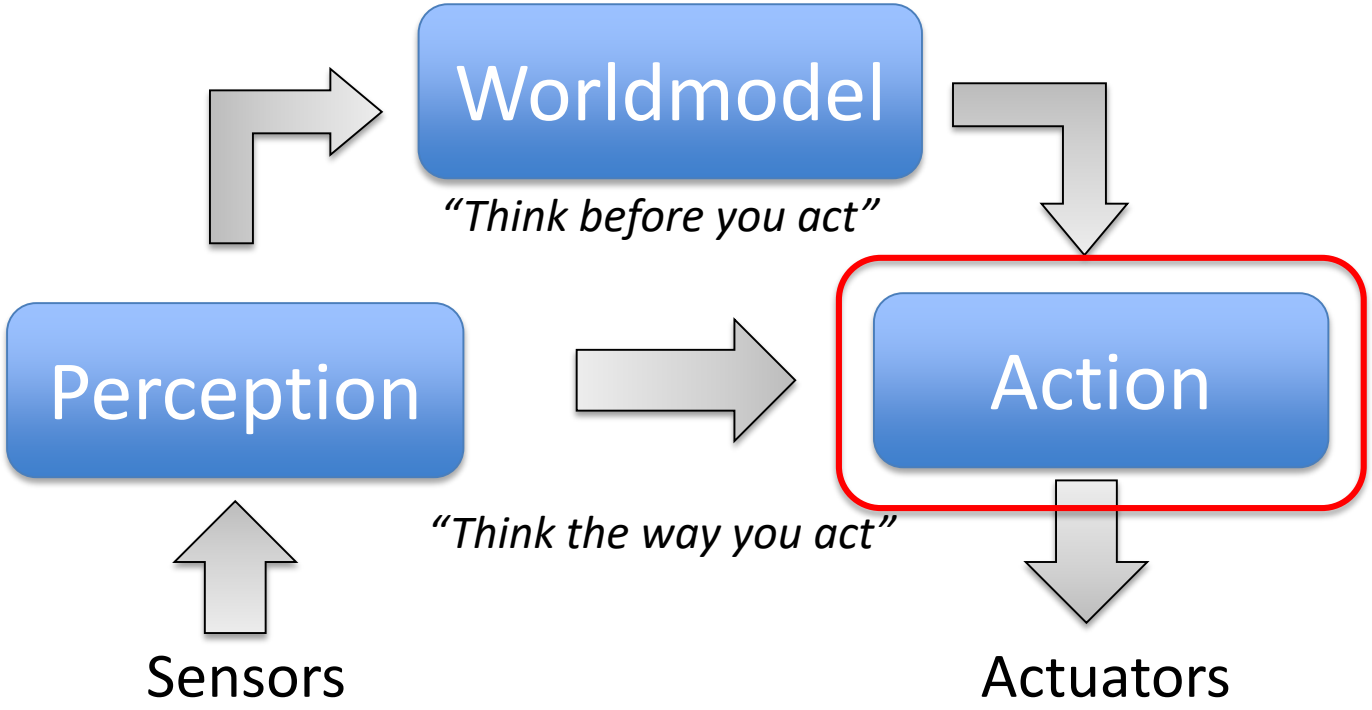
Robot Software Architecture



Action Selection

- Model based

STATE

WorldModel

POLICY

ACTION

Skills

Move
Intercept
Dribble,
Pass,
Shoot
…

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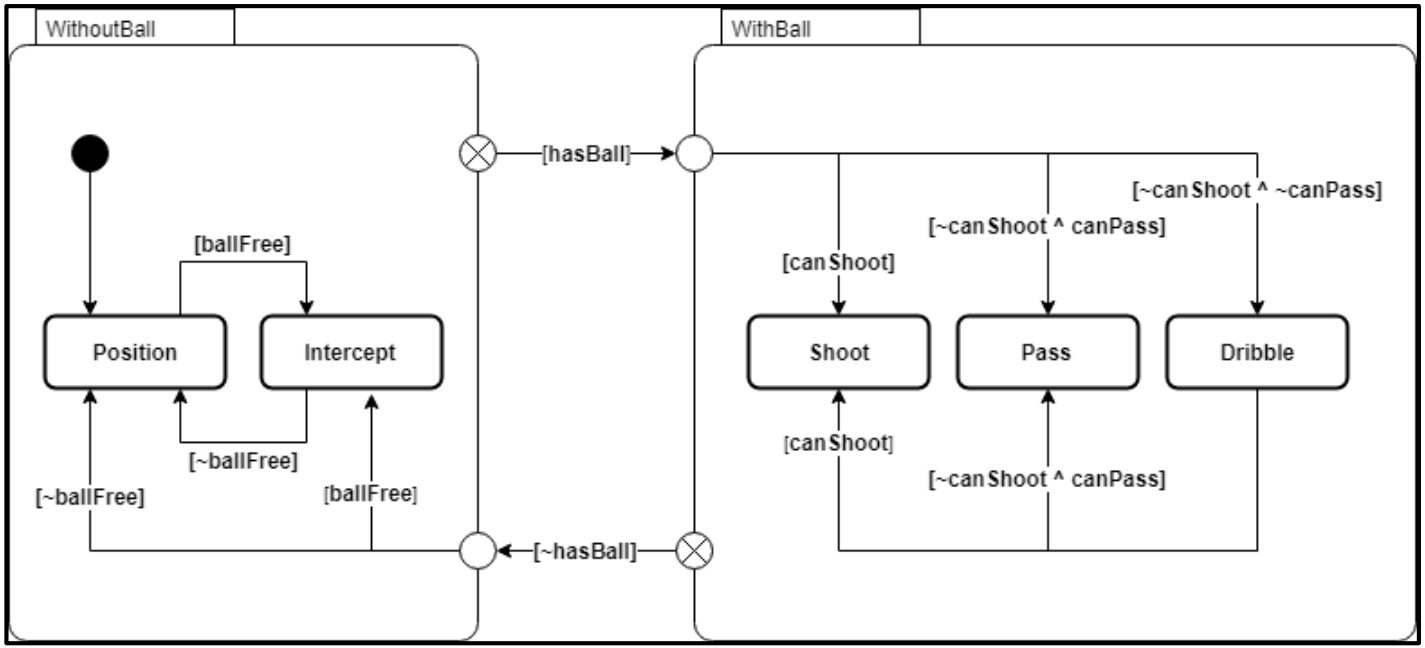
State machine



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Behavior tree

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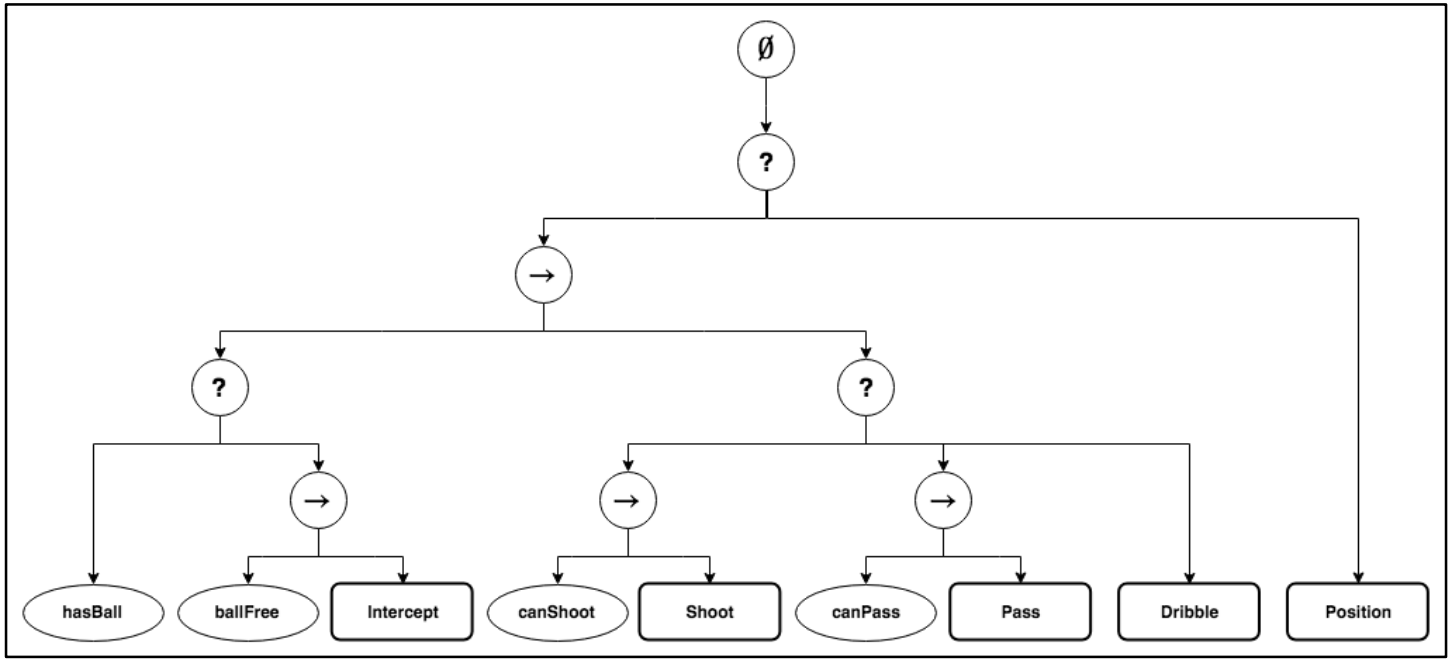
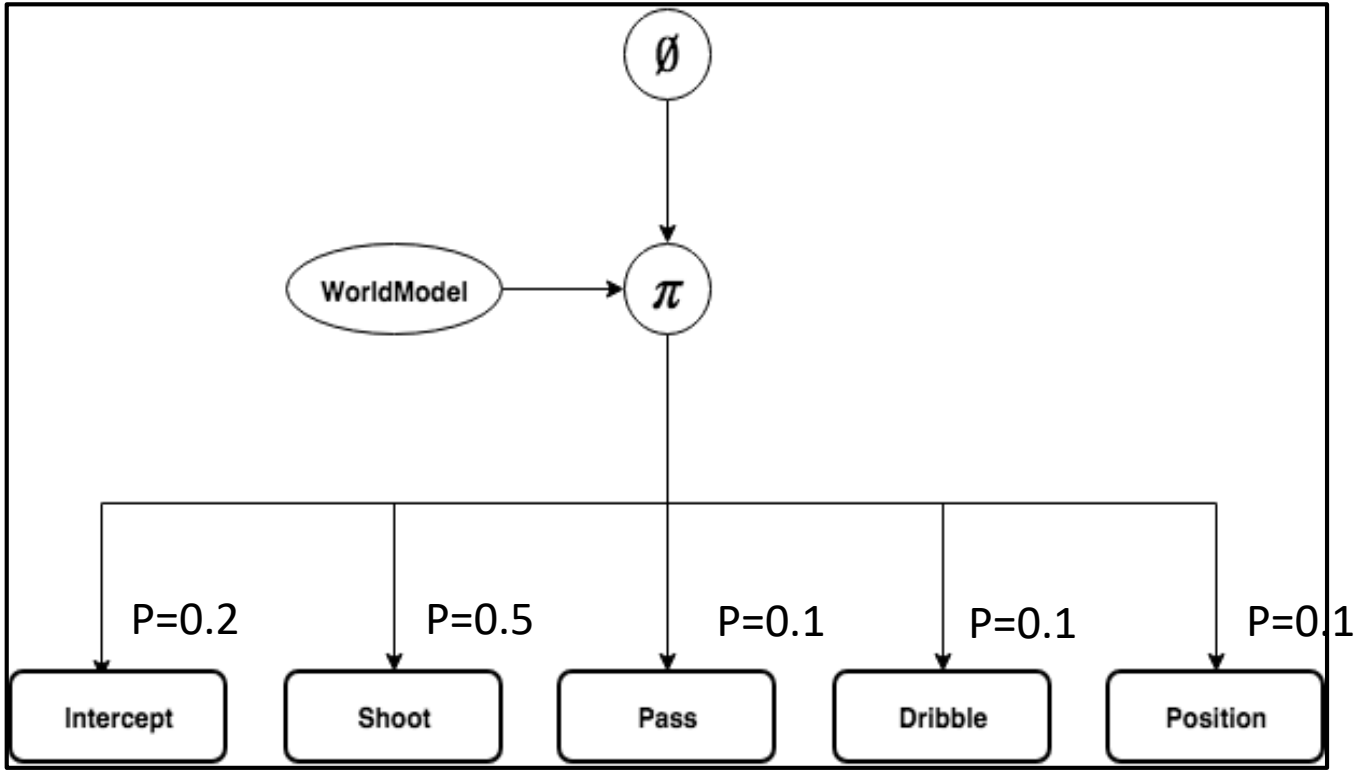


Neural Network



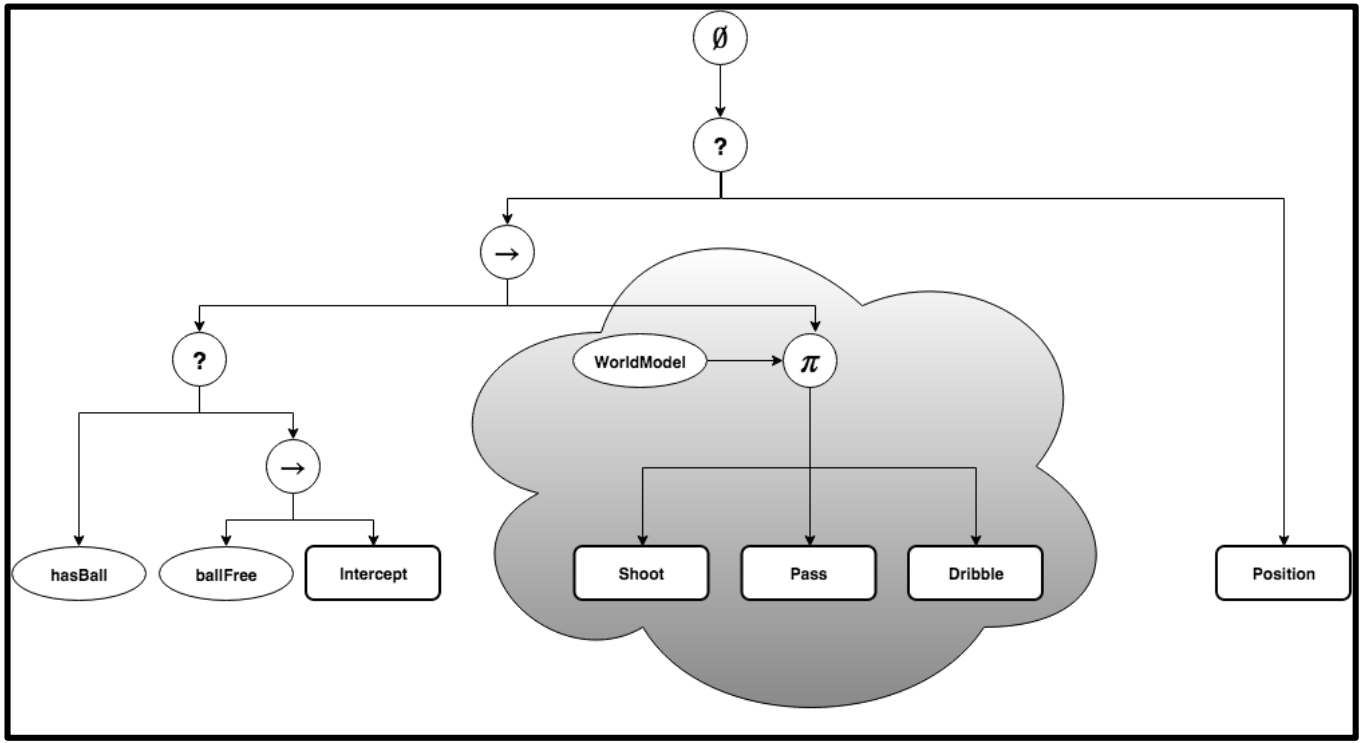
Action selection models

- Hierarchical State Machine
  - Verifiable
- Behavior Tree
  - Maintainable
- Neural Network
  - Trainable

	HSM	BT	NN
Maintainable	-	+	--
Explainable	+	+	-
Verifiable	+	-	-
Trainable	-	-	++

(Andova, Dortmans, Punter, 2019)

Combination of models



Thank you

- Questions or remarks?

- Portfolio of our research: www.htesfontysict.nl