Cloud-Based Social Robotics

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AGENTÚRA
NA PODPORU
VÝSKUMU A VÝVOJA

Structure of the talk :

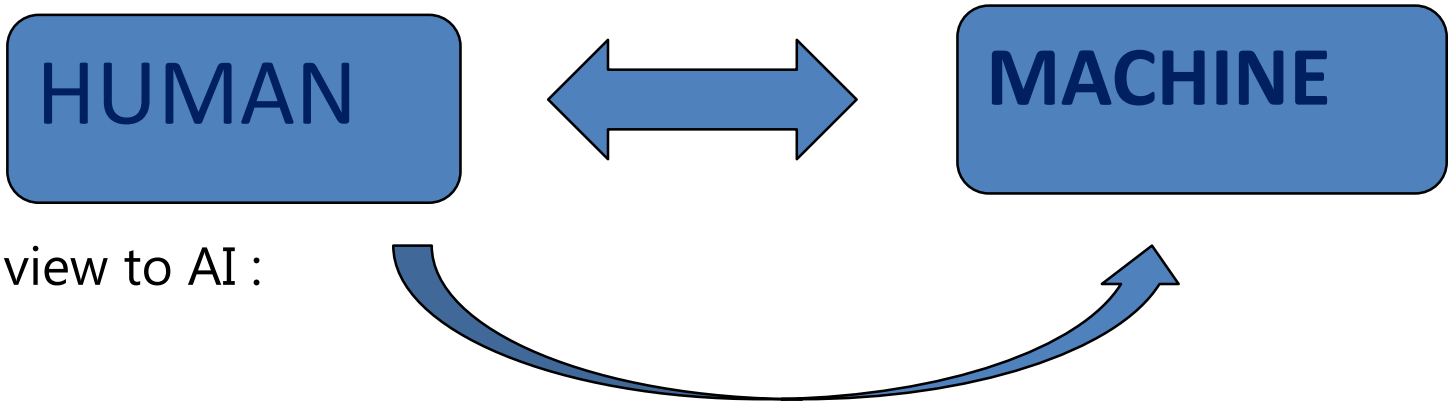
- **Synergy of AI (CI) and Robotics**
- Cloud Based Robotics
- Main challenges in HRI – done @ our Lab
- Vision about upcoming challenges
- Conclusion

Artificial Intelligence & Robotics

- **Artificial Intelligence versus – Computer technology / Cloud Computing approach** / revolution in programming
- **Robotics people are revealing many "old" things in AI to apply in Robotics – it is a very big problem for collaboration**
- **Soft computing and common sense AI is still doing a great job in making things easier**

What is Artificial Intelligence ???

Many definitions ...



Simplified view to AI :

AI – takes LABOR from HUMANS and gives it to Machine

What is Knowledge ?

It is a big problem to make a definition
It is a mathematical function approximation – so knowledge is

“IF – Then”

BIG DATA

Machine IQ – theory

MIQ is IQ is in correlation of the „amount“ of Labor taken from Human and given to Machine during particular TASK (T) .

We do assume GIQ-T is constant 1

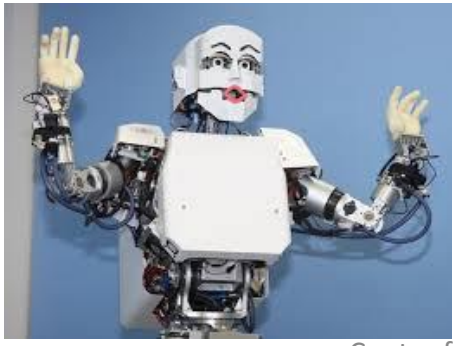
GIQ-T = HIQ-T + MIQ-T

HIQ-T and MIQ-T are from interval <0,1>

Can we develop collective Intelligence for Robots ??

WILKI

WORLD Incremental Learning Knowledge Integrator

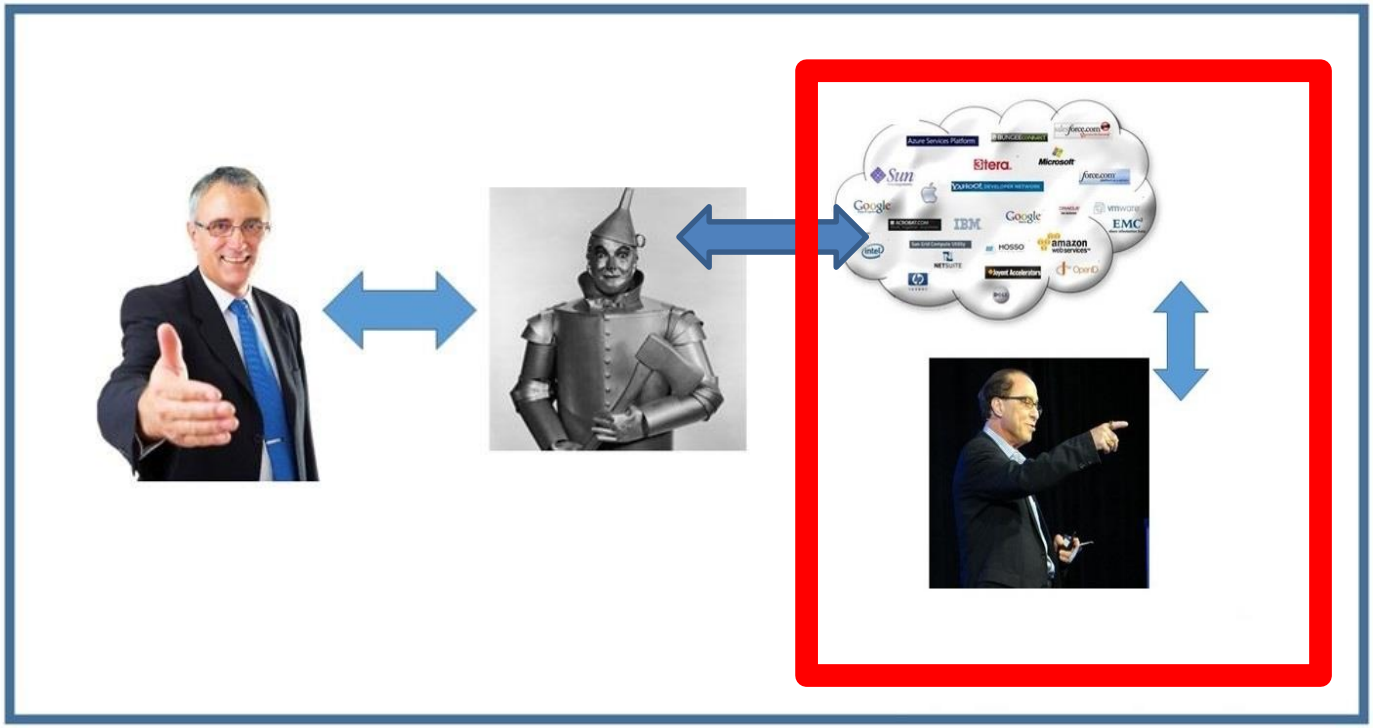


Human-Robot Interaction

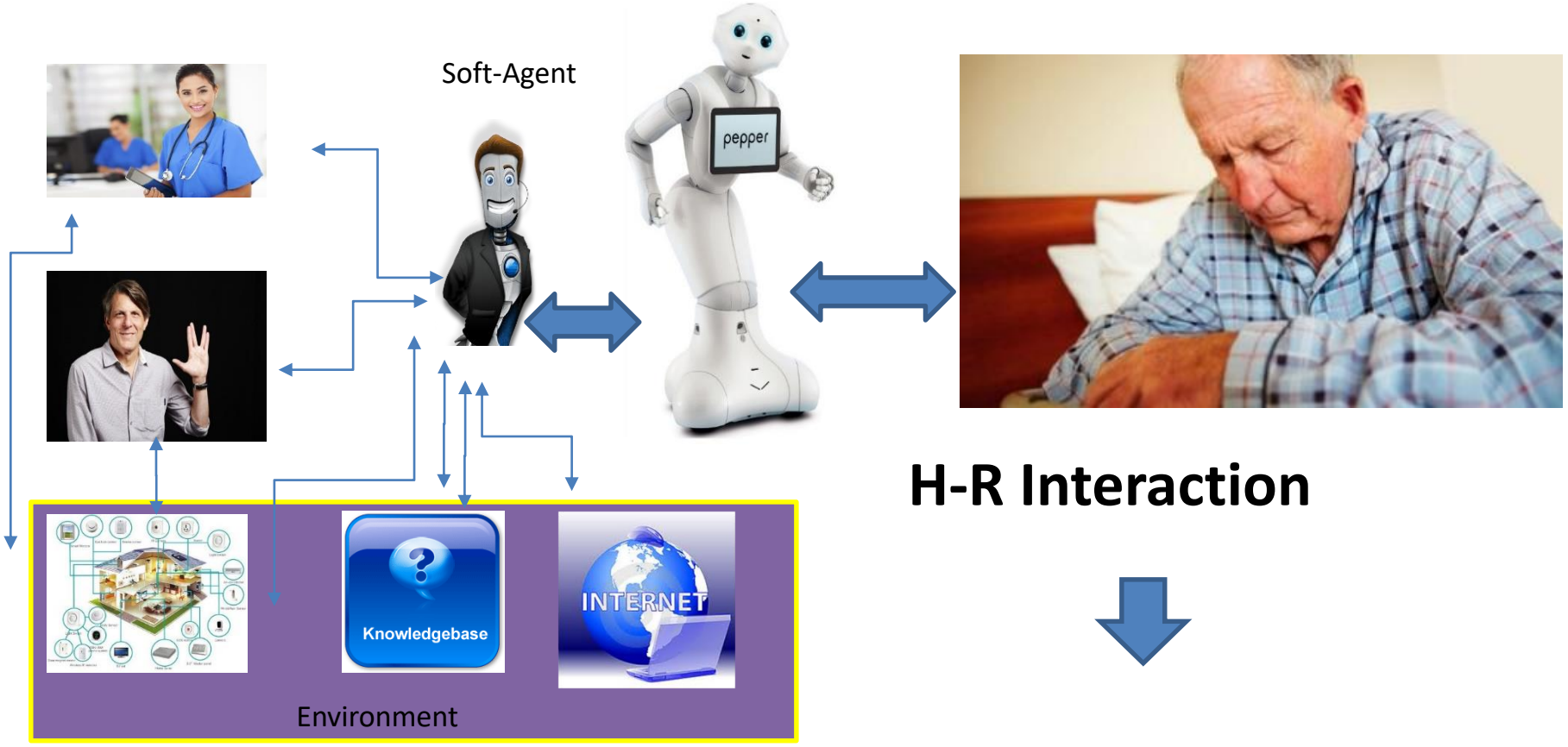
Social Environment

Industrial Environment

Wizard of Oz for Teleoperation in Human-Robot Interaction



Human-Robot Interaction – new paradigm - What is Wizard of Oz



H-R Interaction

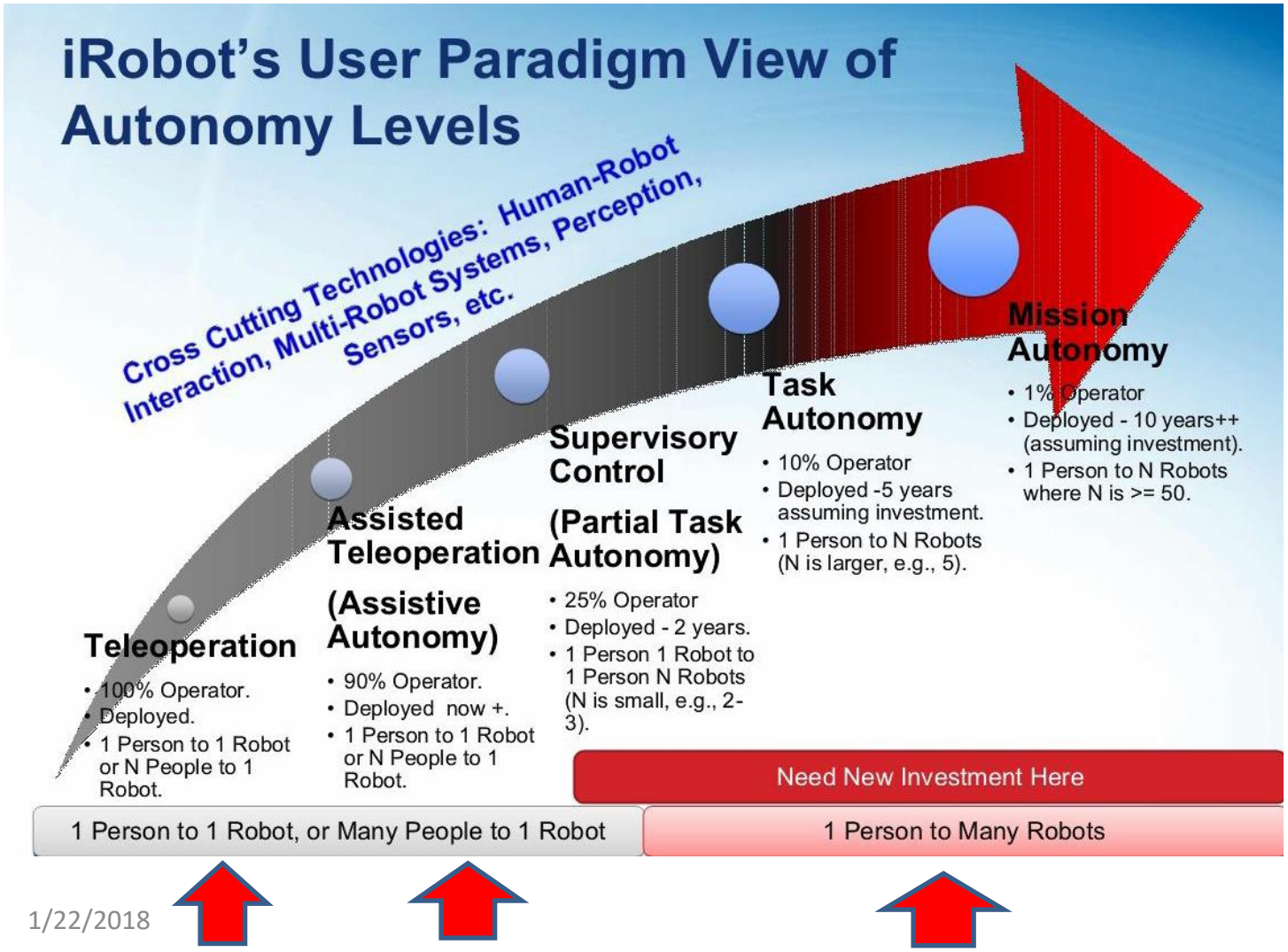
H-R-E Interaction

What is Wizdard of Oz ?

Wizard of Oz = TELEOPERATOR

We want him to have LESS and LESS work and AI should TAKE his WORK over

Qua Vadis Intelligent Robotics ???



Very important for Robot applications

…….

many Technological challenges

Legal Issues and Learning Systems

- **Who will be the owner of the Robot ?**
- **Who will be responsible of new LEARNED action of the Robot ?**
- **Will the robot be able ask for help / create another robot #2 ?**
- **Who will be the owner of robot #2 ?**
- **…**

Legal Topics of Humanity and we will have to face these problems - Set up some rules for the Human World and Robot World

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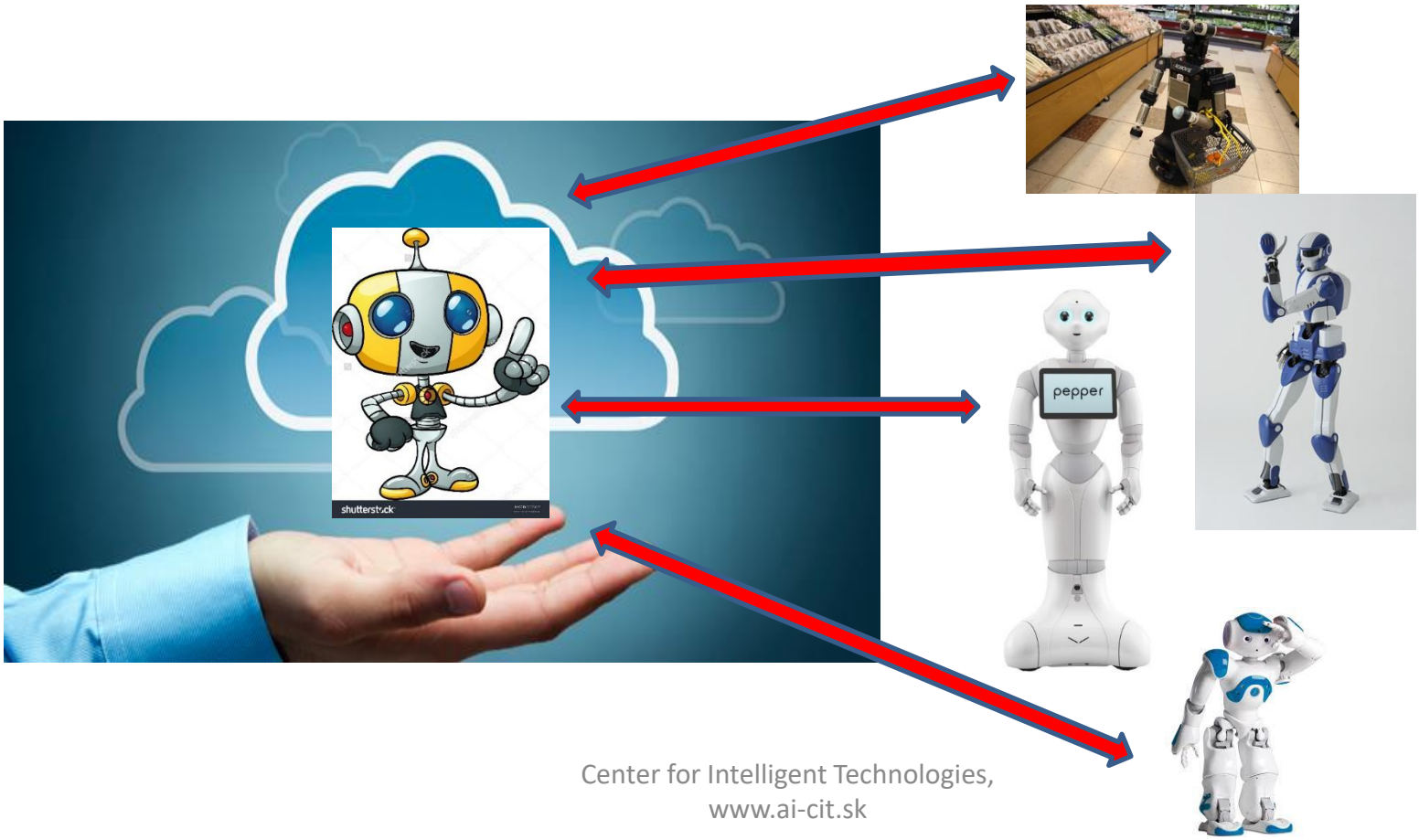
What is a Robot ??

Classical Robot Concept of TODAY

This is a Robot !!!!

Virtual Robot Concept ???
This is a Robot



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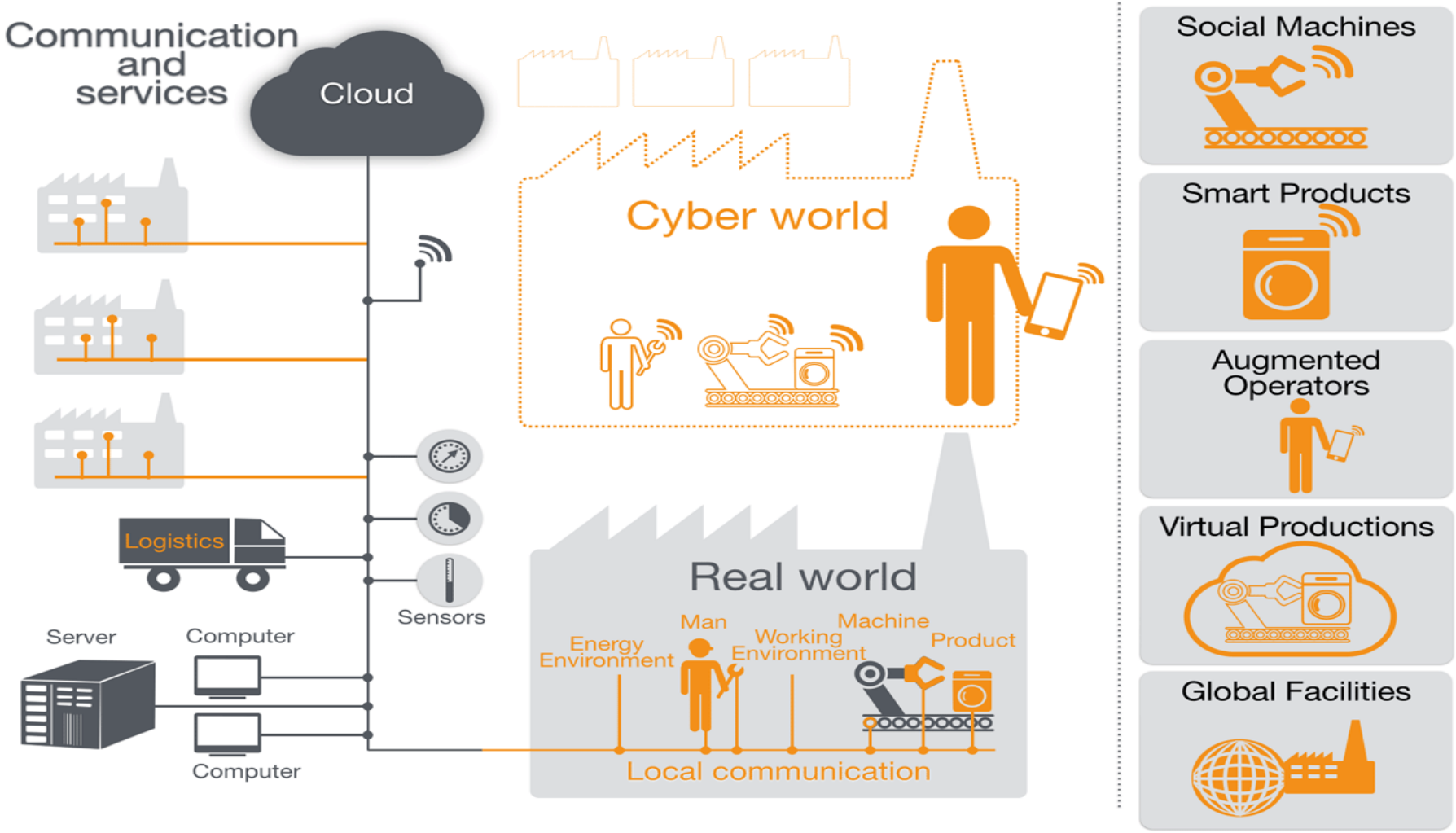
Industry 4.0 – impact to factories of future



What is Cloud … ???

Cloud Computing

Having secure access to all your applications and data from any network device

Example …. Office 365 …. From Microsoft

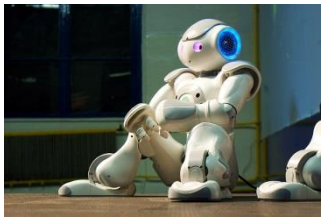
Will Cloud Robotics change AI ??

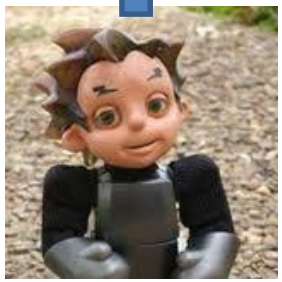
- Will it change AI ? Machine Learning ???
- Will computer speed, storage and fast wi-fi change AI ??
- Do we need a thinking machine ?????
- to ask – means to think or find an answer ???
- AI bricks – granularity of AI problem solving

Our approach to the problem

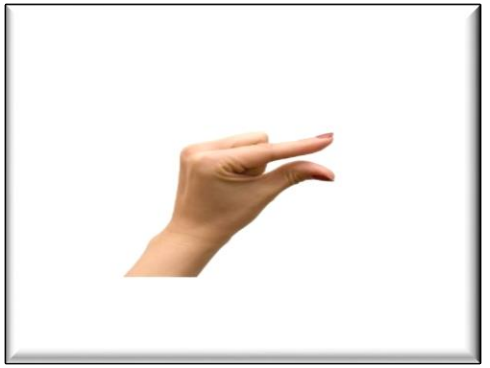
TELEOPERATION
MONITORING

INTERFACE – middleware on CLOUD





Cloud Computing Approach



THINK BIG – START SMALL !!!!

Conclusion part #2

Cloud Robotics & Artificial Intelligence

The only solution for Intelligent Robots

Collective Intelligence for Robots will be matter of trade and commercial applications using Cloud Robotics in FoF and Service (Social) Robotics will happen in Ambient Assisted Living

and Silver Economy is expected

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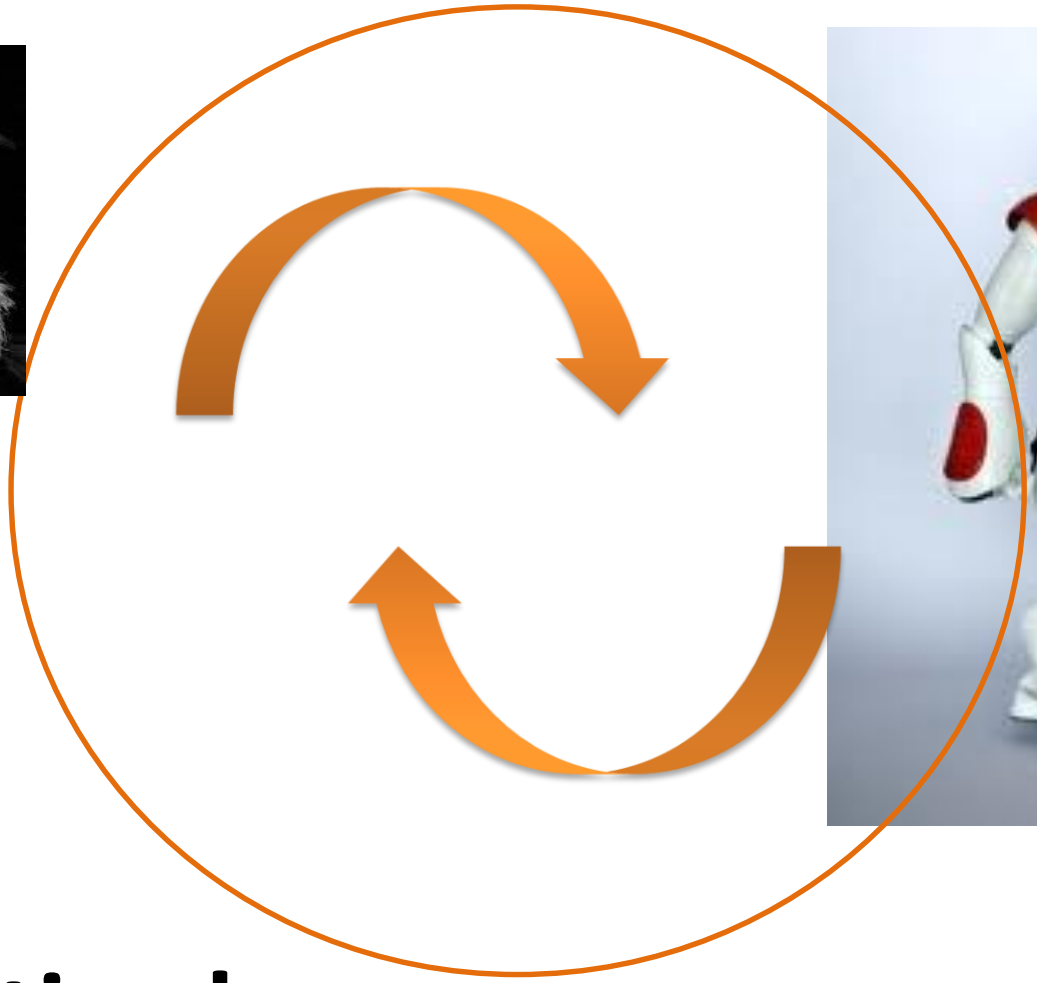
Emotional Interaction – Human centric



Affective loop

Our priority :

Cloud Based Emotional **Affective Loop** as a behavior model concept of interaction (sensing + action)

A) How to estimate an emotional state of the human for ANY purposes **(sensing)**

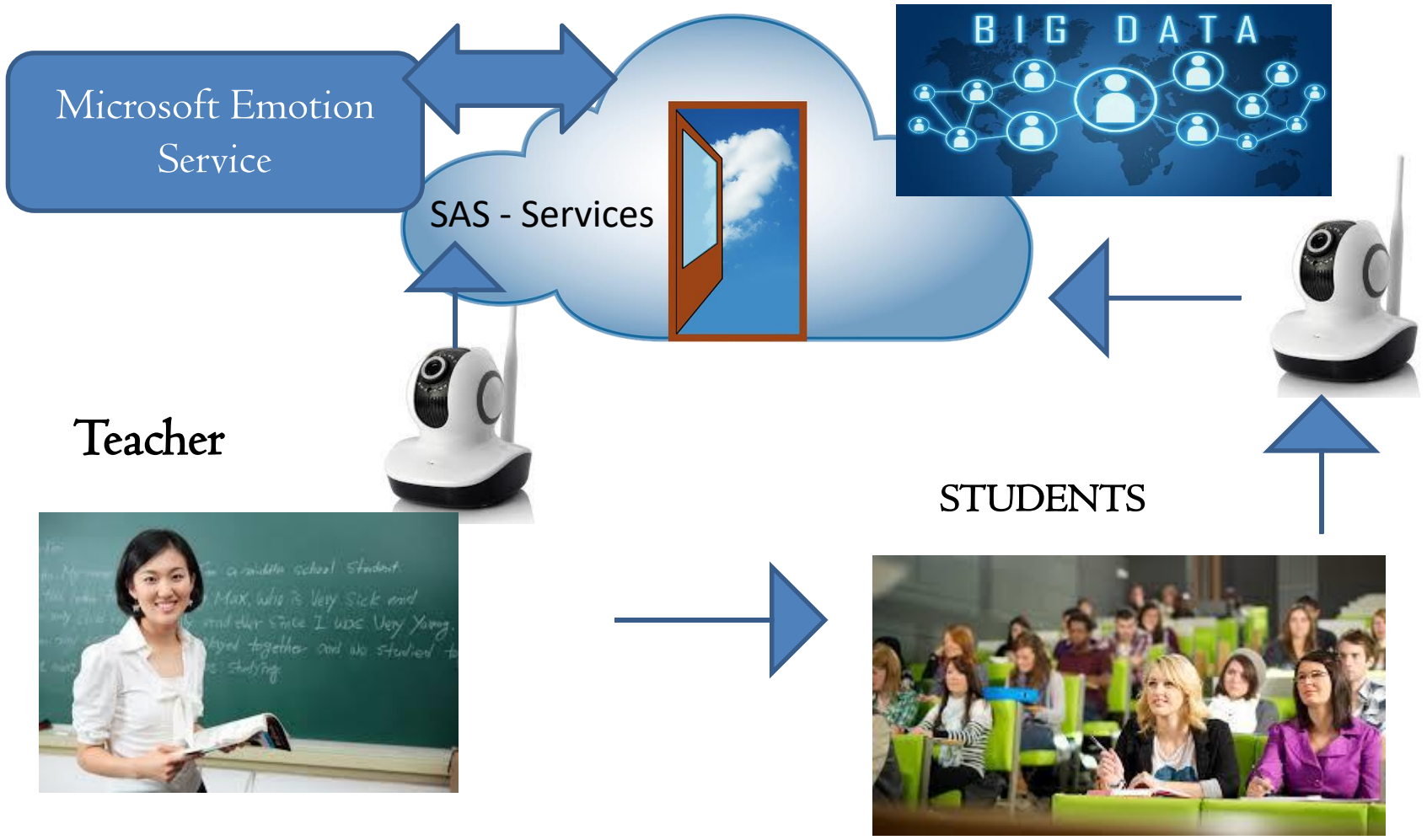
B) Teleoperation with Learning **(action)** – **Wizard of Oz** with learning – towards non-human wizard …

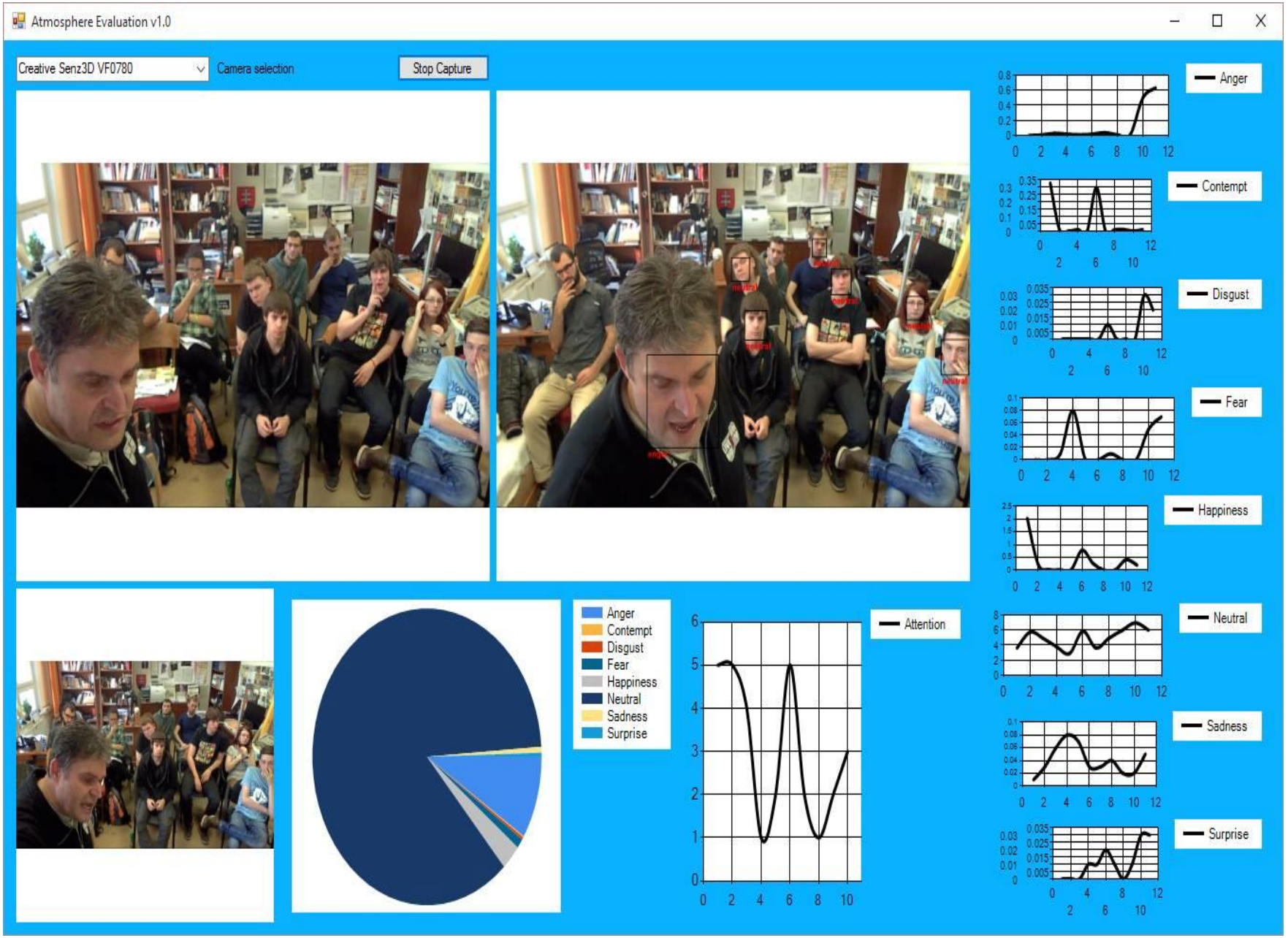
Applications – Why to know emotions assessment of people ???

- Human Computer/Robot Interaction
- Improvemnt a collective wellbeing in companies
- Prevention of depression states of Humans
- Any indication about the state of emotion of the client
- …

Sensing in Affective Loop

Improve Teaching
analyze students response




Atmosphere Evaluation v1.0
Creative Senz3D VF0780
Camera selection
Stop Capture
Anger
Contempt
Disgust
Fear
Happiness
Neutral
Sadness
Surprise
Attention

Action in Affective Loop

Video … (4 minutes)

https://www.youtube.com/watch?v=n5uJlZmN6Vw

Conclusion part #3

Cloud Based Affective loop with Cloud Based sensoring and Cloud Based Wizard of Oz is a way to Autonomous Human Robot Interaction

Commercial Applications with Emotions are expected including emotional sensing of humans and also syntetic Emotions of Robots Towards Humans

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Major Challenges in synergy of Robotics and AI (personal View)

1. **Importance of software in Robotics increase**
2. **Shared Knowledge will be essential**
3. **Evolving Cloud Based Robotics Platform for Robotics will be business based standart**
4. I do believe in **Industry 4.0** concept FofF
5. **Strong connection between Robotics and AI is needed – to prevent reinvention of systems**

Future - undergoing work

Integration of

Cloud based Emotion recognition

and

Wizard of Oz with learning

Into integrated Cloud Based system for Social Robotics for Public Use

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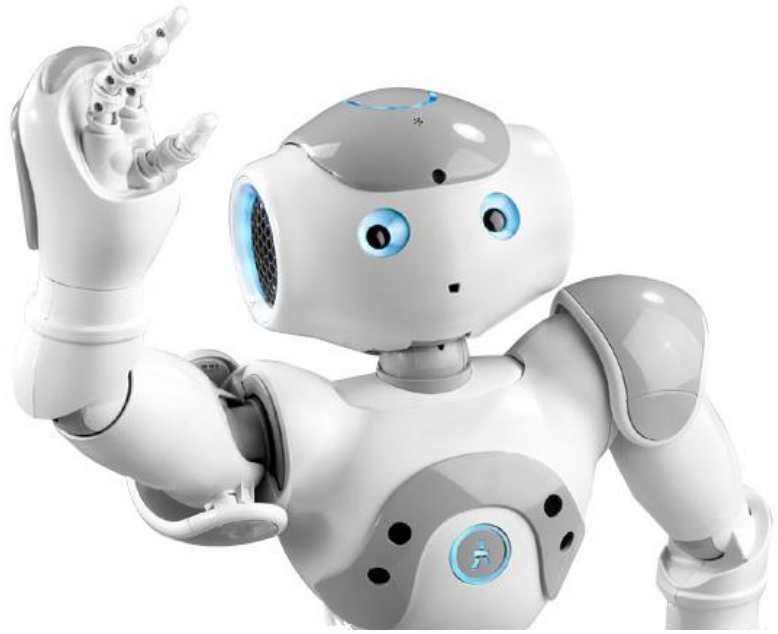
Conclusion #4

We see enormous bussines potential

in Cloud Based Robotics and we focus on Cloud Based Robotics and

building AI for Social Robots using Cloud Infrastructure for HUMANS

Thank you for your time



We would be excited to collaborate, to Exchange research experience , networking meetings, Innovation Seminars …

We are inviting companies also to our Bussines incubators in EU to support and collaborate with students startup Ecosystem

My contacts

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