

## Research in Christian Doppler Laboratories



Application-orientated basic research  
Cooperation between science and business

"A research group elaborates fundamental knowledge that flows into the development of new products and processes at commercial partners"

Industrial partners of our Christian Doppler Laboratory **ARTIS**



It offers software and consulting services  
for workforce/working hours issues

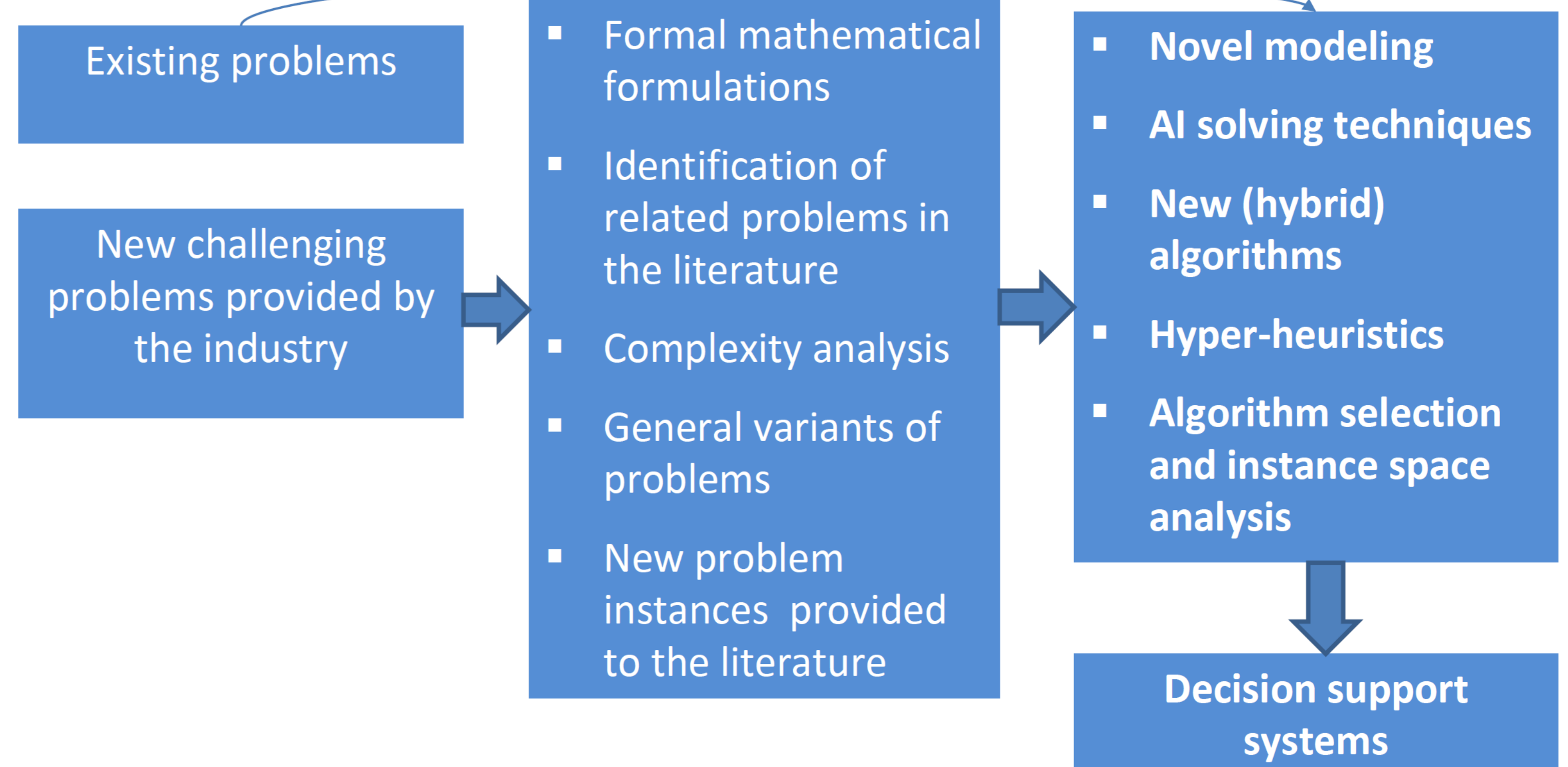


Its core expertise is capacity and  
production planning and scheduling



Leading global supplier of  
technology and services

## Research work in the CD Lab ARTIS

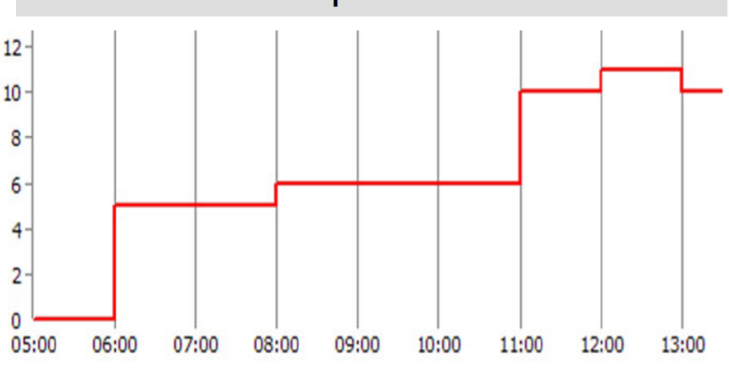


<https://cdlab-artis.dbai.tuwien.ac.at/>

## Real-Life Problem Domains

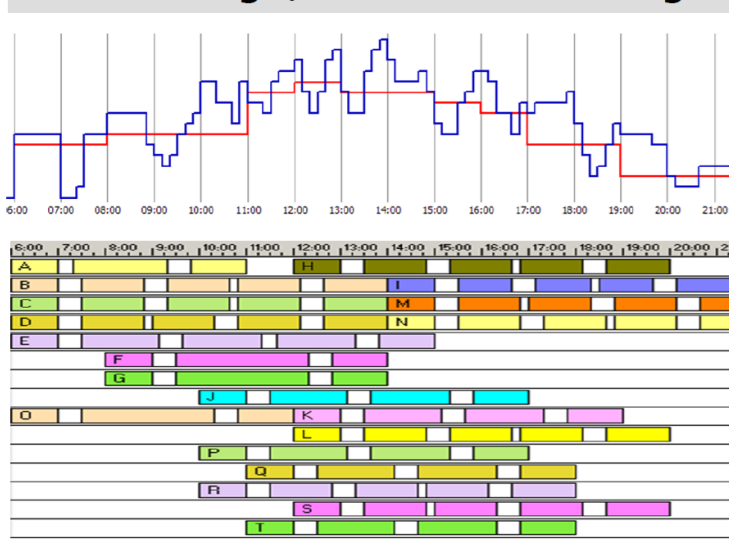
### Employee Scheduling Problems

#### Phase 1: Workforce requirements



<https://www.ximes.com/>

#### Phase 2: Shift Design/Break Scheduling



#### Phase 3: Assignment of shifts

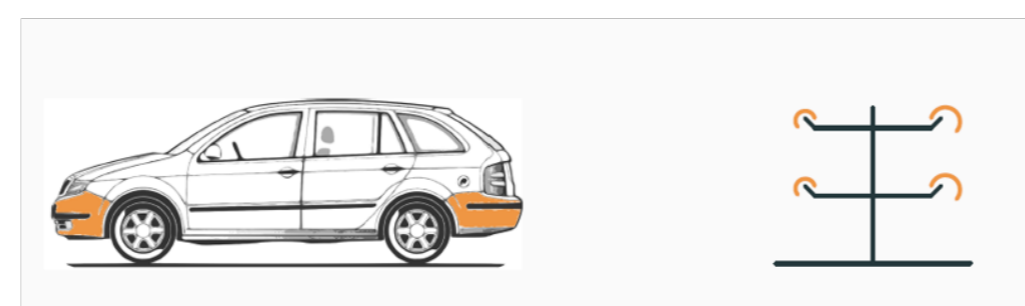
	Mo	Tu	We	Th	Fr	Sa	Su
A	F	F	F	S	S		
B		N	N	N	N	N	N
C		F	F	N	N	N	N
D		S	S	S	N	N	
E	N			F	F	S	S
F	S			F	F	F	F
G	S	S			F	F	F
H	F	S	S		S	S	
I	N	N	N				

Work schedules influence the lives of employees

Organizations in the commercial and public sector must meet their workforce requirements and ensure the quality of their services and operations

### Production Planning and Scheduling

- In these applications it is important to
  - Reduce resource consumption, including energy
  - Increase production efficiency...



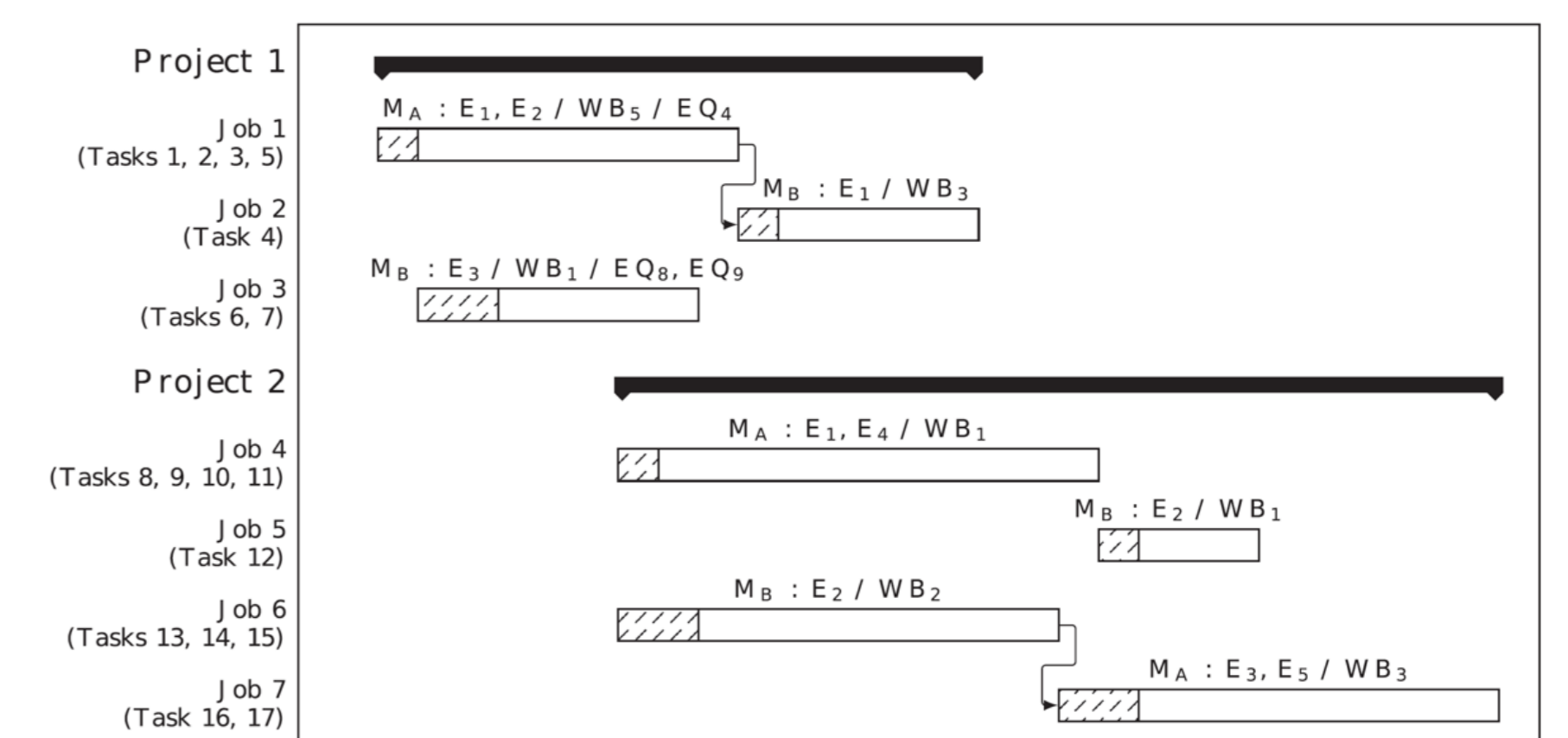
	R1	R2	R3	...
1	A	A	C	...
2	A	A	C	...
3	A	C	C	...
4	B	B	B	...
5	B	B	B	...



Machine 1: 1-2-11-4-5-6-7

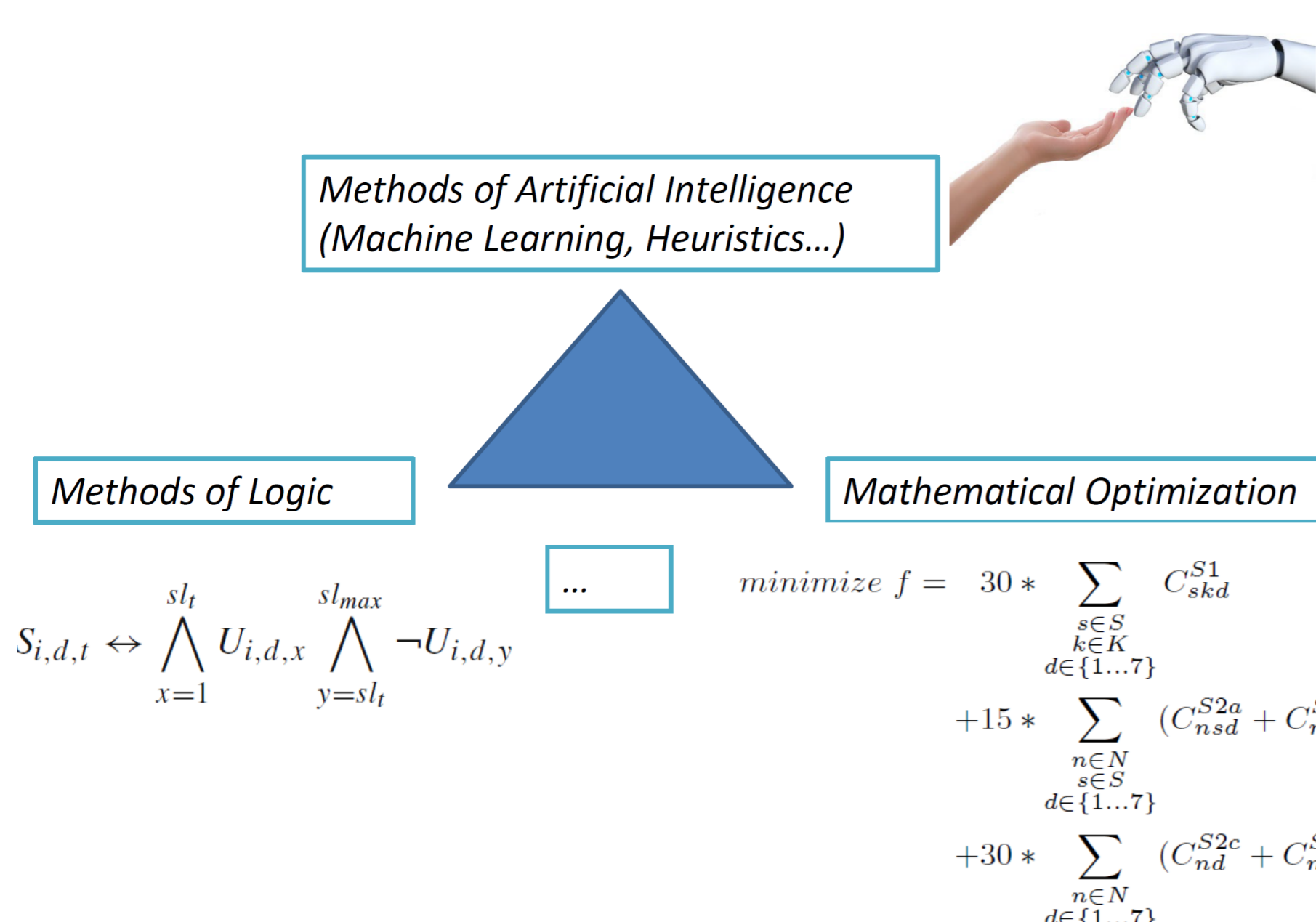
Machine 2: 8-9-10-3-12

### Test Laboratory/Project Scheduling

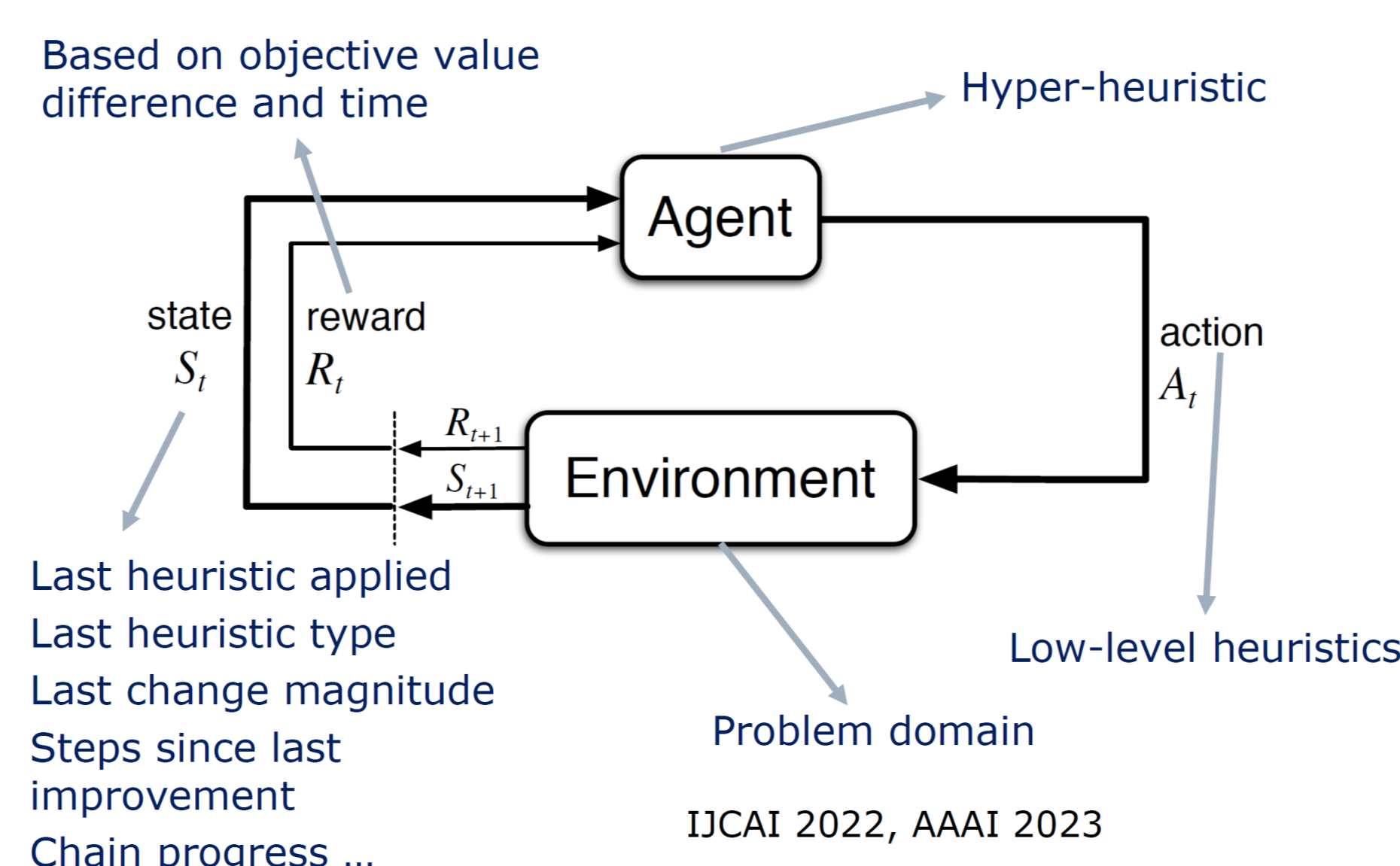


More examples in health care, production, education, public transport, ...

## AI and Hybrid Methods



## Reinforcement Learning



## Conclusions

- Many optimization problems in industry are still solved manually
- AI and optimization offer tremendous potential for further improving solutions in these domains
- Using of machine learning improves results on several real-life domains
- Additional features very important for decision support systems in practice
  - Explanations
  - Guidance for setting weights...

**CD Lab awards:** Two Ressel Awards (2022, 2023), Sub Auspicii Promotion, Best Industry and Applications Paper Award at the A\* conference ICAPS, the Master Thesis Prize from the Austrian Society for Artificial Intelligence, the "Wurdigungspreis" for an outstanding master's thesis in Austria, and the Best Doctoral Consortium Poster Award at ICAPS 2019

Publications: <https://cdlab-artis.dbai.tuwien.ac.at/publications/>