

INSTITUTE OF SOFTWARE SYSTEMS ENGINEERING

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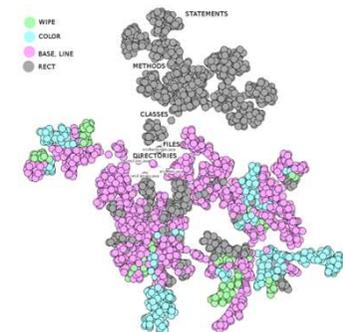
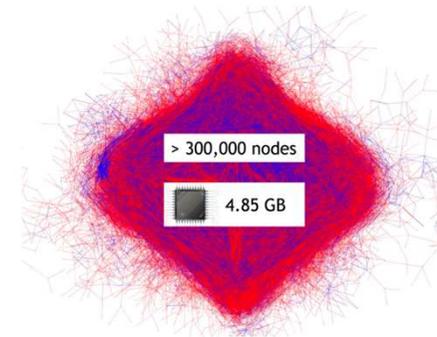
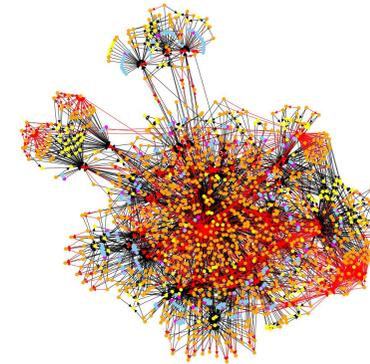


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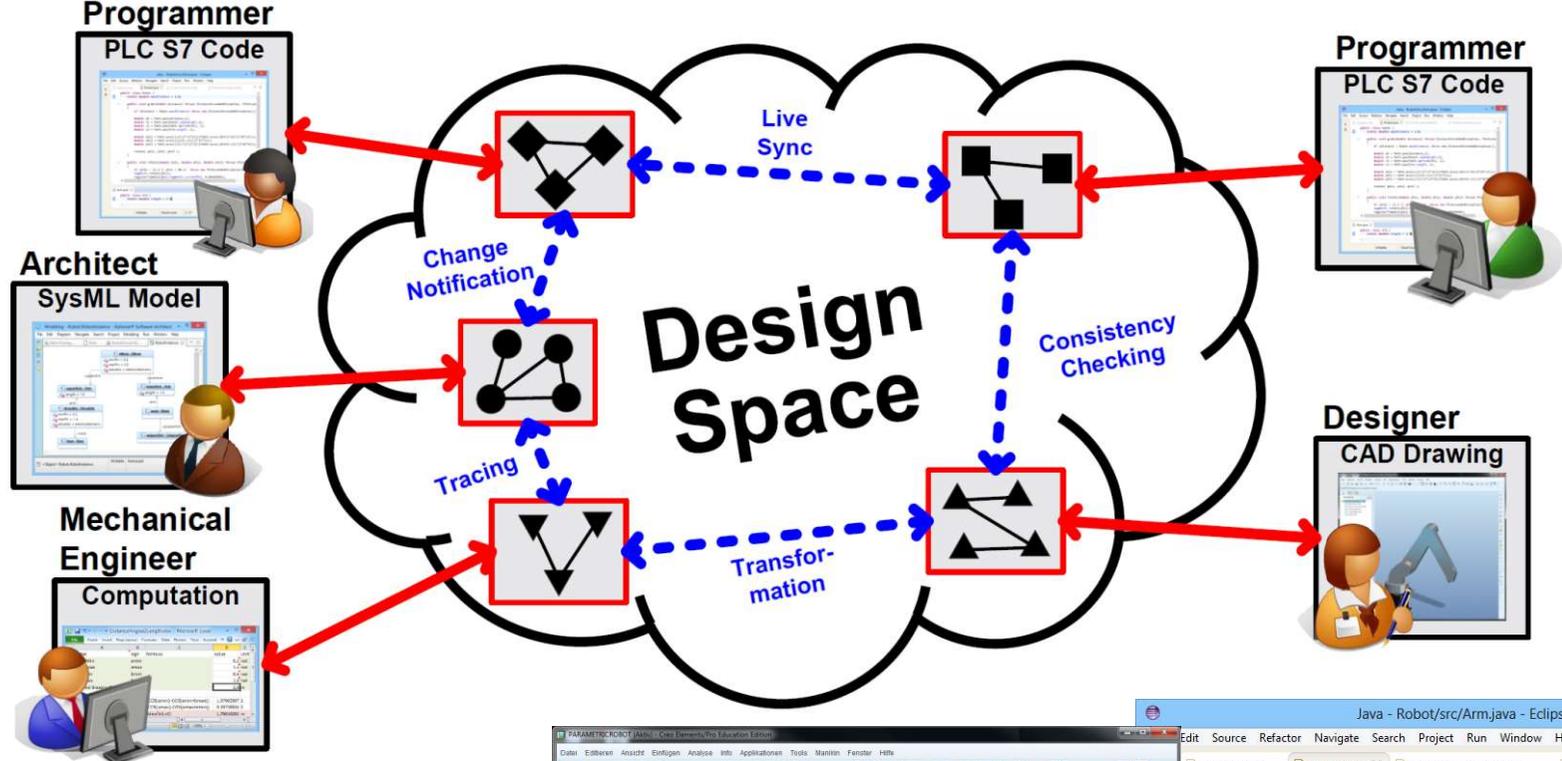
TOPICS OF INTEREST



- Requirements Engineering
- Software Modernization
- Product Lines and Reuse
- AI for Software Engineering
- Multi-User Modeling
- Error Detection and Repair
- Domain-specific Languages
- Human Computer Interaction
- Process Modeling
- Traceability and Maintenance
- Testing, Monitoring, and Debugging
- Simulation and Digital Twins
- ...

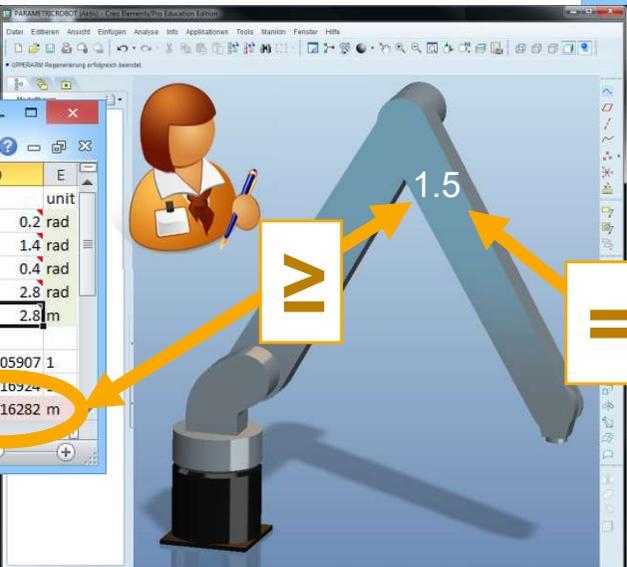


INTEGRATED AND COLLABORATIVE ENGINEERING



DistanceAngles2Length.xlsx - Microsoft Excel

	A	B	C	D	E
1	name	sign	formula	value	unit
2	alphaMin	amin		0.2	rad
3	alphaMax	amax		1.4	rad
4	betaMin	bmin		0.4	rad
5	betaMax	bmax		2.8	rad
6	desired GraspingDistance	d-des		2.8	m
7					
8	maxNormedRadius	r1	$(\text{COS}(\text{amin})-\text{COS}(\text{amin}+\text{bmax}))$	1.97005907	1
9	minNormedRadius	r2	$(\text{COS}(\text{amax})-\text{COS}(\text{amax}+\text{bmin}))$	0.39716924	1
10	minArmLength	x	$\text{d-des}/(\text{r1}-\text{r2})$	1.78016282	m



```

Java - Robot/src/Arm.java - Eclipse
public class Robot {
    static double maxDistance = 2.0;

    public void grab(double distance) throws DistanceExceededException, PhiExceededException {
        if (distance > Robot.maxDistance) throw new DistanceExceededException();

        double d2 = Math.pow(distance,2);
        double h2 = Math.pow(Robot.safeHeight,2);
        double c2 = Math.pow(Math.sqrt(d2+h2), 2);
        double l2 = Math.pow(Arm.Length, 2);

        double phi1 = Math.acos((c2/(2*c2*l2))+Math.acos((d2+c2-h2)/(2*d2*c2)));
        double phi2 = Math.acos((l2+l2-c2)/(2*l2*l2));
        double phi3 = Math.acos((c2)/(2*c2*l2))+Math.acos((d2+h2-c2)/(2*d2*h2));

        rotate(phi1, phi2, phi3);
    }

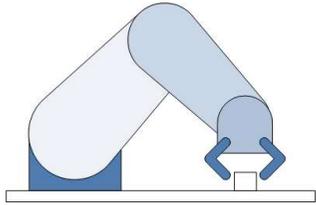
    public void rotate(double phi1, double phi2, double phi3) throws PhiExceededException {
        if (phi1 < 11.5 || phi1 > 80.2) throw new PhiExceededException();
        segment1.rotate(phi1);
        registerTimeout(phi1-segment1.currentPhi, 0.86666666);
    }
}

Arm.java
static double Length = 1.5;
    
```

FEATURE-ORIENTED PRODUCT LINES

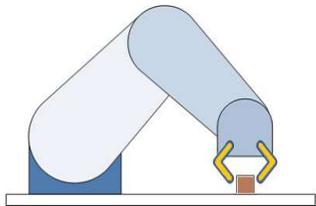
Existing Products

Robot 1



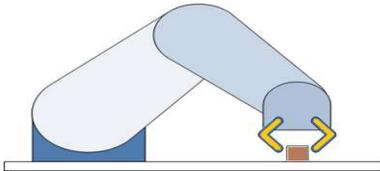
Short Upper Arm
Short Lower Arm
Blue Gripper

Robot 2



Short Upper Arm
Short Lower Arm
Yellow Gripper

Robot 3

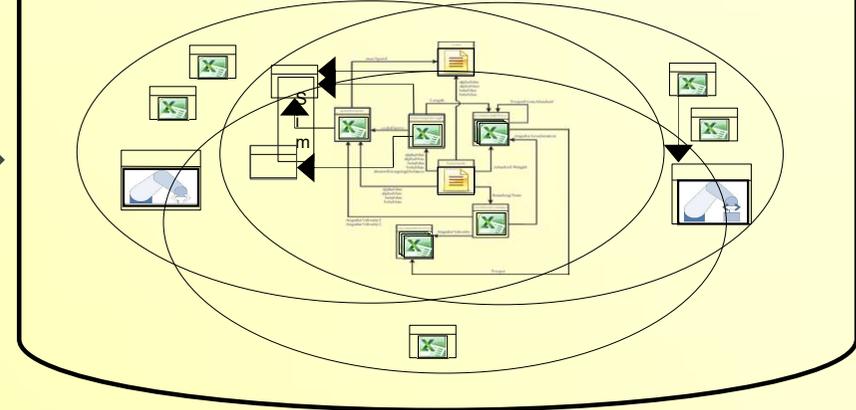


Long Upper Arm
Long Lower Arm
Yellow Gripper

Extraction

Compares products to identify commonalities and differences

ECCO Fragment Repository

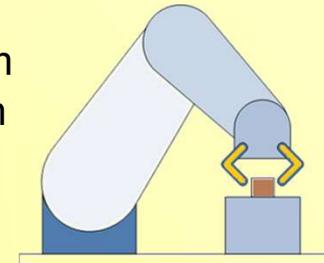


Composition

Commonalities and Differences are stored as Product Fragments

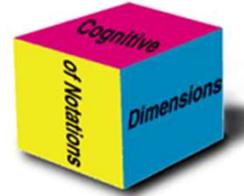
New Robot Composed from Existing Fragments

Short Upper Arm
Long Lower Arm
Yellow Gripper
Pedestal **NEW!**

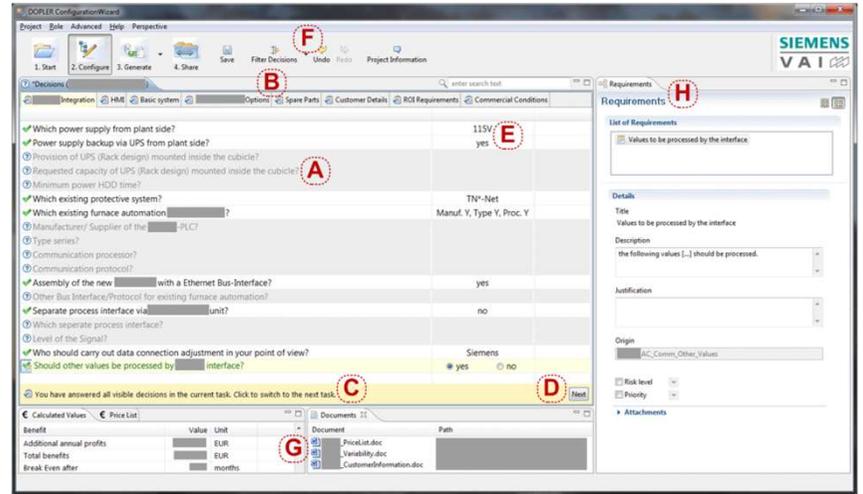


Completion

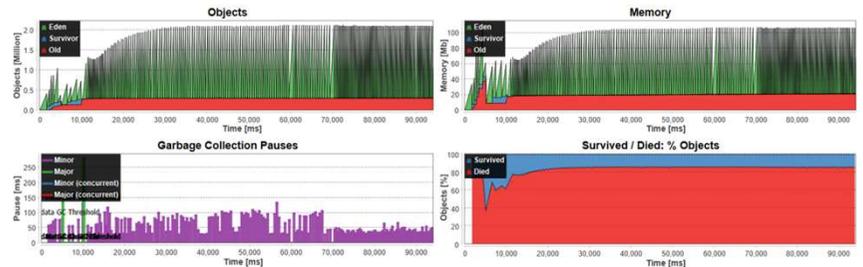
HUMAN COMPUTER INTERACTION IN SOFTWARE ENGINEERING



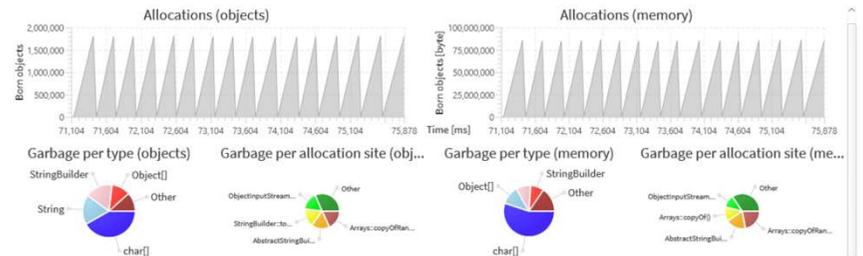
Example: Cognitive Walkthroughs



Task	Detection: Memory Growth	Inspection: Evolution over Time	Inspection: Single Point in Time	Inspection: Single Point in Time	Detection: Memory Churn	Inspection: Evolution over Time	Cross-Cutting		
AntTracks View	Overview	TrendViz View	Heap State View	Graph View	Details View	Short-living Objects View			
Cognitive Dimensions	Abstraction	Overview uses easy terminology.	Abstraction into chart series -> improve by ...	Maybe terminology? Data structure DSL	Nodes represent groups of objects -> understandable? ...	GC chart	Is the content of the tree view clear?	Terminology, icons, etc.	
	Closeness of Mapping	GC chart	Drill-down feature may not be clear. The hierarchical ...	Tree visualized as hierarchical TreeTableView	How to display different elements (Objects, GC roots ...)	GC chart	Tree visualized as hierarchical TreeTableView		
	Consistency	Evolution data is by default presented as charts in AntTracks.		Hierarchical data is by default presented as TreeTableView	To achieve immersion and closeness of ...			Other column names than on heap state view.	Are there annoying inconsistencies?
	Diffuseness		Overcrowded classifier selection, also see viscosity.	Classifier selection is too complex. Highlight most ...	Test that not too many different notations are used, ...	Explanatory text is too long.		Many charts on overview - too many?	Unnecessary or unnecessarily complex views?
	Error-proneness	Possible flaw: Chart interaction. Positive: Zoom ...		Operations in context menu clear? User-defined ...	Make sure that operations that would create too ...	See Overview (Chart interactions)			
	Hard Mental Operations	Do users recognize growing memory as problem?	See abstraction & closeness of mapping.	User is free to use any classifier combination. Certain ...	Even though users can inspect graphs, the detection of ...	Interpretation of charts hard?	Normal classification trees.		
	Hidden Dependencies	Zoom is synced, selection is synced.	Highlight selection in parent chart better. Also display ...	BUG: New classification in heap state may ...				Link from pie chart to table clear?	Are there any dependencies that we did not find yet?
	Premature Commitment		Time window has to be selected beforehand ...	Time has to be selected beforehand. Once nodes are ...	Time has to be selected beforehand. Once nodes are ...				Order of operations, etc.
	Progressive Evaluation	User can check how many of the suggested time ...	Selected value is shown for every level. The more levels ...	Position within classification tree determines progress.	User can always check the path he/she has already ...				
	Provisionality	Can open a new heap state without problems, can ...	All settings can be changed arbitrarily.	Abortion of long running operations is possible.	View is always resettable. Future work: "What-if"-games				
	Role-expressiveness	Memory chart clear. GC chart probably not directly clear.	Is it clear what a single chart is showing?	Should be clear, ask if the tree table visualization was ...	Are the different types of nodes clear?	Charts maybe not clear, check if users understand what ...		Do users understand the charts?	
	Secondary Notation								
	Viscosity		Inflexibility of the classifier selection. Classifiers cannot ...	Order of classifiers cannot be changed using drag-and-...	Graph grows rather fast.			Order of classifiers cannot be changed using drag-and-...	
Visibility	New overview tab was implemented: Now Memory + GC ...	Drill-down feature has been improved (with table, etc.) ...	Should be clear, ask if the tree table visualization was ...	Legend was needed.	Many charts at once, may be overwhelming.			Tab system. Do users find out ...	



(a) The *Details* view plots the application's detailed memory footprint and GC pauses and allows to select a suspicious memory churn time window.



AI FOR SOFTWARE ENGINEERING



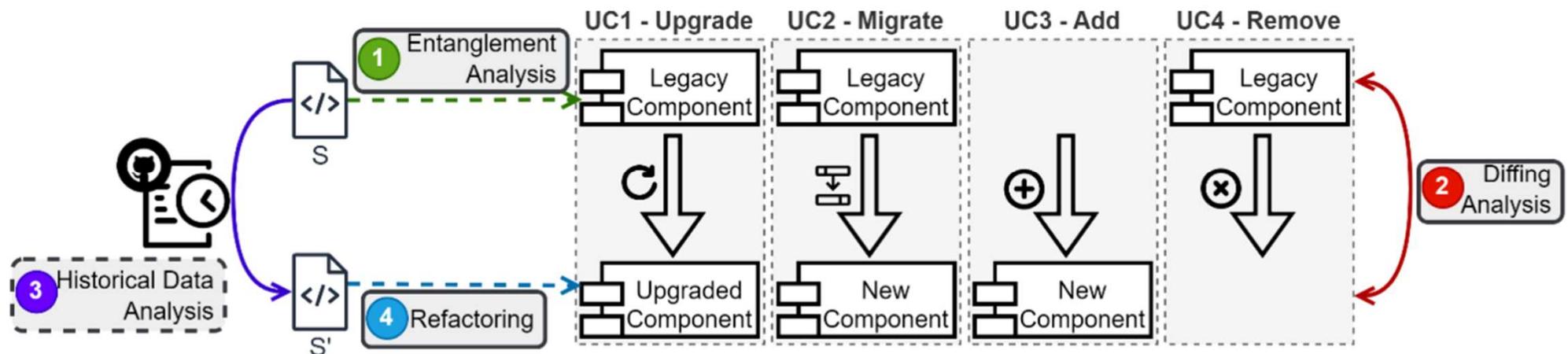
■ **New Project:** RefactorAI

- AI-integrated methodology and tools to assist developers in refactoring tasks associated with legacy systems.



■ Maintaining legacy systems

- Outdated technologies, architectural degradation, high costs, barriers to modernization.



DOMAIN-SPECIFIC LANGUAGES MUSIC ENGRAVING AND MUSICOLOGY

Music Engraving, e.g., LilyPond



```
AltoVoice = \relative c' {
\global
\clef "treble"
\tempo "Très modéré soutenu et expressif" 4 = 96
r 4 cis 2 ^ \mf > \V
e 8 \p \times 2/3 { dis 16 [ e 16 dis 16 ] } cis 8 fis 8 e 8
\times 2/3 { dis 16 [ e 16 dis 16 ] }
cis 2 \V cis 4 < \V e 8 e 16 [ fis 16 ] gis 8
\times 2/3 { fis 16 [ gis 16 fis 16 ] }
e 8 \> dis 8 \V cis 4 cis 4 \V r 4
}

verseAltoVoice = \lyricmode {
Dieu! qu'il la __ fait bon re -- gar -- der
La gra -- ci -- eu -- se __ bonne et bel -- le;
}
```



MusicoLOGY, e.g., DCML

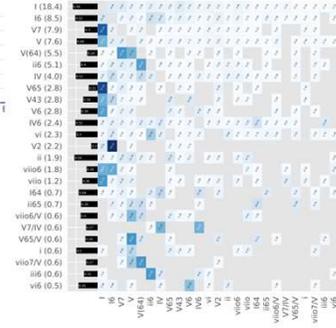
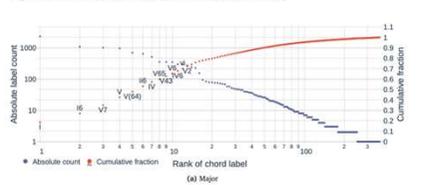
Feature	Encoding	Examples
Global key	Name.	Ab . I, g# . i
Local key	RN.	v . i, bVII . I
Chordal root	RN	I, bII, #vii
Chord type	<NA>, +, o, %, M	viio, IV+
Chord inversion	<NA>, 6, 64, 7, 65, 43, 2	I6, ii%65
Replacing interval(s)	()	V(64), i(#74)
Added interval(s)	(+)	I(+6), V(+b9+4)
Lower-level reference	/RN	V7/V, #viio/i
Phrase boundary	{, }, }{	V}, I6{
Pedal point	RN[]	I[V7/IV IV I]



mc	mn	quarterbeats	timesig	staff	voice	label
16	16	60	4/4	2	1	V(64)}
16	16	121/2	4/4	2	1	V HC
16	16	62	4/4	2	1	{
globalkey		localkey	form	figbass	changes	relativeroot
C		I			64	
C		I				
C		I				
cadence	phraseen	chord_tones	added_tones	root	bass_note	
	}	1, 0, 4		1	1	
HC		1, 5, 2		1	1	



Figure 5: Distribution of pitch classes over the dataset. [interactive]



YOUR BACHELOR THESIS: THREE OPTIONS

- Propose and pursue a topic of your interest
- Contribute to an ongoing research project
- Carry out thesis project in collaboration with an industry partner

CONTRIBUTE TO AN ONGOING ISSE RESEARCH PROJECT

- We are a partner of Pro2Future, the SCCH, and the ACCM
- FWF Projects
- FFG Projects
- EU Projects
- LIT Secure and Correct Systems Lab

- Visit www.isse.jku.at for more details

CARRY OUT YOUR THESIS PROJECT IN COLLABORATION WITH AN INDUSTRY PARTNER



PROPOSE AND PURSUE A TOPIC OF YOUR INTEREST

Please contact one of the supervisors at the institute to discuss your idea!

- Alexander Egyed
- Paul Grünbacher
- Christoph Mayr-Dorn

