Seminar Summer Term 2018
Reasoning, Planning, and Scheduling with Uncertainty

Gerhard Lakemeyer	gerhard@kbsg.rwth-aachen.de
Jens Claßen	classen@kbsg.rwth-aachen.de
Stefan Schiffer	schiffer@kbsg.rwth-aachen.de
Tim Niemueller	niemueller@kbsg.rwth-aachen.de
Martin Liebenberg	liebenberg@kbsg.rwth-aachen.de
Till Hofmann	hofmann@kbsg.rwth-aachen.de

Reasoning, Planning, and Scheduling with Uncertainty

What is this seminar about?

- Starting Point:

  Planning: Determine a sequence of actions to reach a goal state
  e.g., PDDL

  Reasoning: Model the world and the agent's actions in logic
  e.g., Situation Calculus

  Scheduling: Distribute a set of tasks to machines to minimize cost
- New: uncertainty $\rightarrow$ probabilities
- Actions are non-deterministic or stochastic
- Uncertainty is inherent in many applications, especially robotics
- But dealing with probabilities makes those problems even harder

Reasoning, Planning, and Scheduling with Uncertainty

Goal of the seminar:

- Investigate stochastic extensions to previously deterministic approaches
- Analyze the kind of uncertainty that is modeled, e.g.,
  - non-deterministic vs stochastic
  - uncertain action durations
  - probabilistic effects
- What is the advantage compared to a deterministic approach?
- What is the additional cost of a probabilistic approach?
- Is it feasible in practice?

The Seminar

- Seminar counts as one of:
  - Bachelor CS seminar
  - Master CS seminar in Data and Information Management
  - Master CS seminar in Theoretical Computer Science
  - Master SSE seminar in Data and Information Management
  - Master SSE seminar in Theoretical Foundations
- Your task is to
  - read paper(s) about a topic
  - write and talk about it
  - read and listen to the others, give feedback
- These slides are available on the seminar website:

  `https://kbsg.rwth-aachen.de/teaching/SS2018/SemReaPSUn`

Rough Outline

Five stages:

1. Understand literature; explain to advisor — 4 weeks
2. Write and submit the seminar paper — 6 weeks
3. Review two fellow students' seminar papers — 2 weeks
4. Prepare final seminar paper and slides — 3 weeks
5. Give talk, listen to others, ask questions — Aug 06-07

1 / 5: Literature

- One or two papers assigned to each topic
- Read them carefully
- Understand them thoroughly
- Sometimes: have a look at basic or related literature
  - check the bibliography of the paper(s) assigned to your topic
  - ask your advisor for suggestions
  - to understand the basics, or
  - to compare to other approaches
  - usually no need to read the complete paper, but
  - be sure enough what it's about before
- What's good / bad about the approach?

2 / 5: Seminar Paper (Ausarbeitung)

- Your seminar paper should
  - Give an overview of the topic
  - Convey the **idea** and **intuition**
  - **Make the topic understandable to the other students**
- 12 pages
- Be concise!
- Typically four parts:
  1. Introduce the general research topic, motivate why it is important
  2. Provide relevant background knowledge required for your topic
  3. Describe your particular approach in detail
  4. Analyze the described approach and compare it to others
- English and LaTeX mandatory
- Use the template from the seminar website

3 / 5: Review

- Your review should
  - help your fellow student to improve his seminar paper
  - prove that you read it thoroughly
- Typical structure
  - Summary of the seminar paper ($\approx$ 3 sentences)
  - Things you liked about it ($\approx$ 1 paragraph)
  - Major comments (e.g., what's hard to understand?)
  - Minor comments (e.g., typos)
- Reviewing should be **anonymous**
- **Plain text** following the above structure
- Do **not** annotate the seminar paper inline (no attachments)

4 / 5: Final Paper

- Read reviews
- Revise your paper accordingly

5 / 5: Talk

- Convey the **idea**, a good **intuition**, and the **major results**
- Offer something to everybody:
  1. Start gently with informal examples
     to motivate problem and sketch solution (first 40%)
  2. Go deeper into details (next 30%)
  3. Conclude at a high level of abstraction (last 10%)

5 / 5: Talk

- Convey the **idea**, a good **intuition**, and the **major results**
- Offer something to everybody:
  1. Start gently with informal examples
     to motivate problem and sketch solution (first 40%)
  2. Go deeper into details (next 30%)
  3. Conclude at a high level of abstraction (last 10%)
- 25 minutes talk + 10 minutes discussion
  - Do not exceed 25 minutes, practice your talk
  - Rule of thumb: at least 90 seconds per slide
- English and PDF mandatory

5 / 5: Talk

- Convey the **idea**, a good **intuition**, and the **major results**
- Offer something to everybody:
  1. Start gently with informal examples
     to motivate problem and sketch solution (first 40%)
  2. Go deeper into details (next 30%)
  3. Conclude at a high level of abstraction (last 10%)
- 25 minutes talk + 10 minutes discussion
  - Do not exceed 25 minutes, practice your talk
  - Rule of thumb: at least 90 seconds per slide
- English and PDF mandatory
- Tips
  - Motivate with an example
  - Keep that example to illustrate results during the talk
  - Avoid formulas, use example and pictures instead
  - Be prepared for questions (perhaps with back-up slides)
  - Do NOT take this slide as an example :-)

Conference System

- We use a conference system (EasyChair) for the seminar
- We use EasyChair to submit
  1. Seminar papers
  2. Reviews
  3. Revised seminar papers
- Deadlines are **firm**
- You can update your submission until the deadline
- There's no excuse for missing deadlines

- `www.easychair.org/conferences/?conf=semreapsun2018`

Grades

The final grade is the weighted mean of

- the reviews you wrote (10%)
- your final paper (50%)
- your talk (40%)

Rescission Policy

Up to three weeks **from now on** you are allowed to recede from the seminar without any consequences.
A later rescission will be graded as a failed attempt!

Rescission Deadline: May 8

Topic Assignment

- Topics are *not* assigned now
- Instead:
  1. Check the list of topics at home
  2. Read the paper abstracts
  3. Rank topics from most to least preferrable
  4. Send me your ranking
- Topics are assigned based on the *household allocation* algorithm

Topic Assignment with Household Allocation

- Basic idea:
  1. Assign randomly
  2. Swap until no improvement is possible
- Implementation:

  `https://github.com/morxa/seminar-allocation`
- Example:

```
Smith, Pell: Parachute use to prevent death and major trauma related
     to gravitational challenge: systematic review of randomised
    controlled trials
Wright: Academia Obscura: The hidden silly side of higher education
Cham, Whiteson: We have no idea


Kenny McCormick
2 Smith, Pell: Parachute use to prevent death and major trauma
    related to gravitational challenge: systematic review of
    randomised controlled trials
2 Wright: Academia Obscura: The hidden silly side of higher
    education
1 Cham, Whiteson: We have no idea
```

Topics

1. PPDDL1.0: An extension to PDDL for expressing planning domains with probabilistic effects
2. Heuristic Guidance for Forward-Chaining Planning with Numeric Uncertainty
3. Interval-Based Relaxation for General Numeric Planning
4. Provably-correct stochastic motion planning with safety constraints
5. From FOND to Robust Probabilistic Planning : Computing Compact Policies that Bypass Avoidable Deadends
6. Logical Filtering and Smoothing: State Estimation in Partially Observable Domains
7. Probabilistic Planning by Probabilistic Programming
8. A Temporal Logic for Planning under Uncertainty
9. Probabilistic Situation Calculus
10. PROPhESY: A PRObabilistic ParamEter SYnthesis Tool
11. Approximation in stochastic scheduling: the power of LP-based priority policies

Schedule

April 17	Introductory Meeting	
April 21	Submit your topic preferences	
April 21	Get an EasyChair[1] account, download paper(s)	
May 18	Discuss literature with your supervisor[2]	4 weeks
June 29	Paper submission deadline[3]	6 weeks
July 13	Review deadline[4]	2 weeks
Aug 03	Paper camera-ready version[5]	3 weeks
Aug 06-07	Seminar talks	2 days

Keep the deadlines:
You can *update* your submission at EasyChair!

[1] `www.easychair.org/conferences/?conf=semreapsun2018`
[2] That's the only deadline that's not firm. It's more of a recommendation.
[3] By this date you *must* have submitted
[4] By this date you *must* have written and submitted your reviews
[5] By this date you *must* have submitted your final seminar paper