Question

• What is(are) the condition(s) that makes an agent useful in scheduling meeting? (explain with examples…)

Contents

• Scheduling of Meetings
• Scheduling Agents
• Calendar Apprentice – decision tree based
• Learning interface agent
  – Memory-based learning
• Some Calendaring Systems
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Scheduling of Meetings (1/2)

• Features
  – Meeting Type, Attendees, Date, Time, Duration, Location, Confirmation, etc.
• Actions
  – Accept/reject.
  – Schedule.
  – Reschedule.
  – Negotiate meeting times.

Scheduling Agents (2/2)

• A learning interface agent
• Automating the scheduling task according to the unique habits of the user
• Conditions*
  – Involve a substantial amount of repetitive behavior of user
  – And, this repetitive behavior is potentially different for different users

Calendar Apprentice*(1/6)

• Typical Training Example of a Calendar Meeting
  – User-entered information

request:5-27-1992-48:
  attendees: thrun
event-type:meeting
date:29 5 1992
time:1430
duration:30
location:weh5309
confirmed?:yes
Calendar Apprentice(2/6)

– Automatically collected information

displayed-week: (25 5 1992)
action-time: 2915977709
action-date: (27 5 1992)
previous-prompt: confirmed=yes

Calendar Apprentice(3/6)

– Additional features inferred by the system

position-attendees: project-scientist
previous-attendees-meeting: request-5-20-1992-1
next-attendees-meeting: none
businesstime: no
number-of-attendees: 1
cmu-attendees?: yes
day-in-week: Friday
attended-in-team-group?: yes
known-attendees?: yes
day-in-week: Friday
end-time: 1500
busyness-of-attendees: 2
single-attendee?: yes

Calendar Apprentice(4/6)

• Rules from those training example

If Position-of-attendees is Grad-Student, and
Single-attendee? is Yes, and
Sponsor-of-attendees is Mitchell;
Then Duration is 60.
[Training: 6/11 Test: 51/86]

If Group-name is EDRC-Directors;
Then Duration is 90.
[Training: 6/6 Test: 31/38]

Calendar Apprentice(5/6)

• Learning Procedure

• Update the performance statistics
• Window-Examples : the most recent 180 training example meetings
• Training-Examples : 120 examples selected at random from Window-Examples
• Test-Examples : Window-Examples – Training-Examples

Calendar Apprentice(6/6)

• Learning Procedure (cont’)

• For each feature f in {Duration, Location, Time, Day-of-week}
  – Learn a decision tree to predict values of feature f →
    using “ID3 algorithm” applied to Training-Examples
  – Convert each path of the learned decision tree into a rule
  – Remove any rule preconditions not decreasing performance for this rule over the Window-Examples
  – Record the number of positive and negative examples it matches from window-examples for each new rule
  – Sort each rule into the previous rules for feature f, based on their accuracy

Learning Interface Agent*

• Memory-Based Learning
  – Situation-action pairs
  – Distance of features
  – Confidence of agent about prediction
• Reinforcement Learning
• Suggesting a meeting time
Memory-Based Learning (1/4)

- Distance between a new situation and a memorized situation
  - Score: $\sum_{i=1}^{n} \frac{1}{d_i}$
  - $d_i$: weighted sum of distances between the values
  - $S$: the set of memorized situations
  - Selecting highest score
  - Computation of weight and distance metrics when new situation being added $\rightarrow$ time-consuming $O(n^2)$

Memory-Based Learning (2/4)

- Confidence of prediction
  - $d_{predicted}$: distance to the closest situation with the same action as the predicted one
  - $d_{other}$: distance to the closest situation with a different action from the predicted one
  - $M$: number of situations considered in making a decision

$$\frac{d_{predicted}}{d_{other}} \times m$$

- $m$: the number of situations considered in making a decision

Memory-Based Learning (3/4)

- Confidence of prediction (cont’)
  - $n_{predicted}$: the number of the closest $m$ situations with distances less than a given maximum with the same action as the predicted one
  - $n_{max}$: minimum 1 or the number of the closest $m$ situations with distances within the same maximum with different actions than the predicted
  - $n_{total} = n_{predicted} + n_{other}$

Memory-Based Learning (4/4)

- Reinforcement Learning in Scheduling meeting
  - Priority Weighting

<table>
<thead>
<tr>
<th>A</th>
<th>P</th>
<th>Accept</th>
<th>Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accept</td>
<td>–</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Decline</td>
<td>Negative</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

- $P$: prediction of agent, $A$: action of user

Suggesting A Meeting Time

- Candidate times $t_1, t_2, \ldots, t_m$
- People $p_1, p_2, \ldots, p_n$
- Preferences $r_{ij}$: $p_i$’s preference rating for $t_j$
- Priorities $q_{ij}$: $p_i$’s assessment of the relative importance of person $p_j$ ($\forall i q_{ii} = 0$) in the range $[-100, +100]$
- Convenience of any given time $t_k$

$$I_k = \sum_{i=1}^{n} \left( \sum_{j=1}^{m} q_{ij} \right)$$

Meeting Maker $^\text{TM*}(1/5)$

New Activity
Lotus Organizer(3/9) 
Invite

Lotus Organizer(4/9) 
Communication via e-mail

Lotus Organizer(5/9) 
Inviting message

Lotus Organizer(6/9) 
Status Update

Lotus Organizer(7/9) 
Confirming invitation

Lotus Organizer(8/9) 
Confirmation message
Lotus Organizer (9/9)

Canceling

Sun Calendar Server*

Crosswind Synchronize (web-based)*

Crosswind Synchronize (web-based)

Yahoo! Calendar*

Yahoo! Calendar
Others

• Crosswind Synchronize
  • http://www.crosswind.com/sitemap.htm#sync

• Web-based
  – Oscal
    • http://www.obsidian.co.za/text/demo.html
  – Bantu
    • http://www4.bantu.com/

Conclusion

• Agent’s learning method
  – Decision tree
  – Memory-based learning

• Commercial complete agents
  – not yet found

• Weakness of web-based scheduling meeting
  – Response time, user-interface

References (1/2)


References (2/2)

