Biological Vision and Applications
Module 07-04: Spatio-temporal relations

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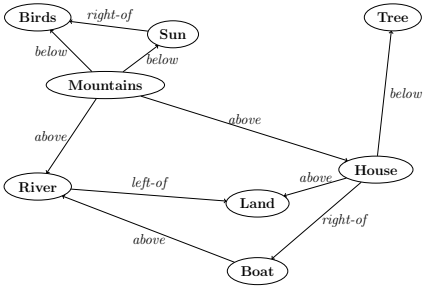
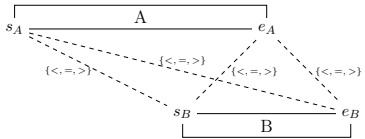
Informal (normative) relations



- The relations “left-of”, “above”, etc. are informal
  - ... lacks semantics
- How do we formally specify them ?

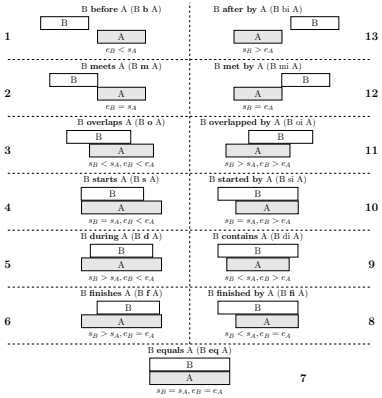
Allen's temporal relations

- An event A spans a finite interval of time
  - Start and end points: s_A, e_A
  - Finite and positive duration: $s_A < e_A$
- Two point events x and y can be has three possible unambiguous relations
  - $x < y$, $x = y$ and $x > y$
- Temporal relation between two interval events A and B can be represented as
  - Comparison 4-tuple of $(s_A, e_A) \times (s_B, e_B)$
  - Are there 3^4 possible values ?



Allen's temporal relations

13 feasible distinct relations



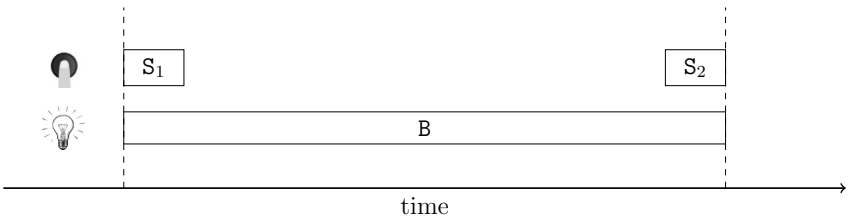
1. $e_B < s_A$: B *before* A
2. $e_B = s_A$: B *meets* A
3. $s_B < s_A, e_B < e_A$: B *overlaps* A
4. $s_B = s_A, e_B > e_A$: B *starts* A
5. $s_B > s_A, e_B < e_A$: B *during* A
6. $s_B > s_A, e_B = e_A$: B *finishes* A
7. $s_B = s_A, e_B = e_A$: B *equals* A

Allen's temporal relations

Allen's temporal relations

Example

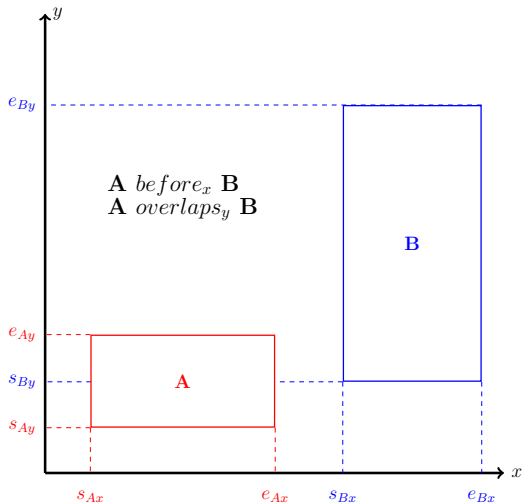
(a) $\mathtt{S}_1$ *before* $\mathtt{S}_2$
(b) $\mathtt{S}_1$ *starts* B
(c) $\mathtt{S}_2$ *finishes* B



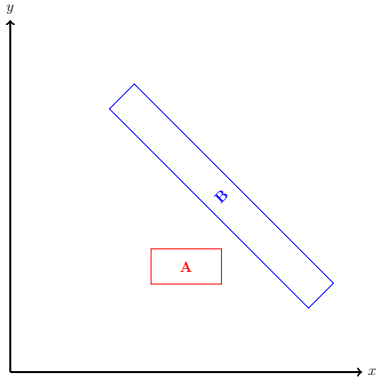
Allen's relations

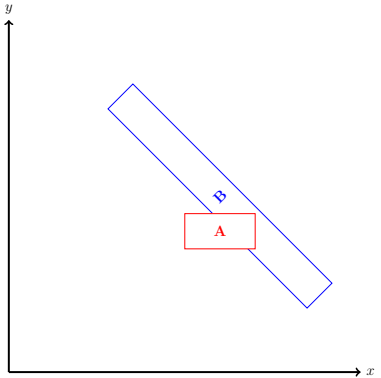
Extension to spatial dimensions

- Can be applied to spatial dimensions as well
  - "before" $\rightarrow$ "left-of" / "below"
- Express spatio-temporal relations as a tuple of allen relations
  - (A b_x B, A o_y B)



Ambiguity: Allen's relations extended to multi-dimensional space

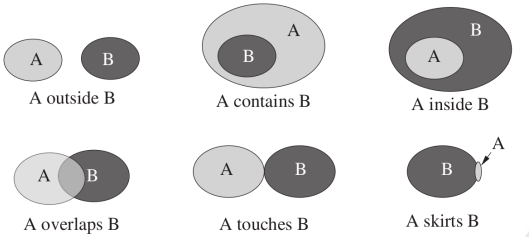




- In both the cases, (A d_x B, A d_y B)
  - Left: A does not intersect B
  - Right: A intersects B

Containment relations (multi-dimensional)

To resolve ambiguity



- In multi-dimensional space
  - Spatio-temporal relations unambiguously defines with
    1. The Allen's relations on projections on each axis
    2. The containment relations (in multiple dimension)

Quiz

No quiz for module 07-04

End of Module 07-04