



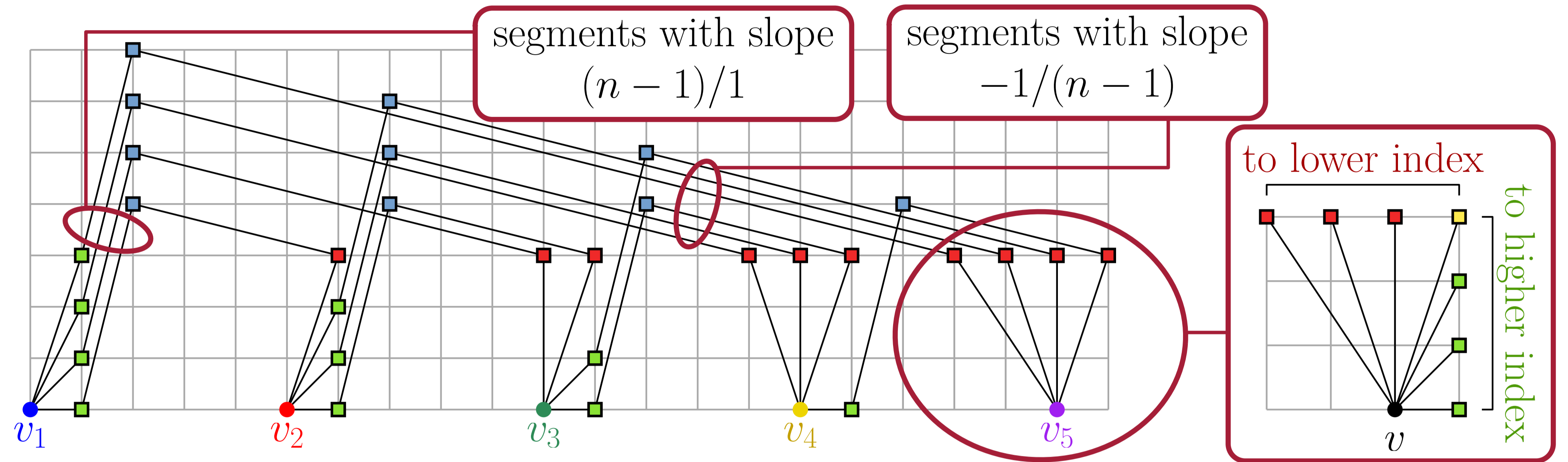
Definition: RAC drawing

- ▶ Edges cross at 90°
 - ▶ RAC: Right-Angle-Crossing
- ▶ geometric embedding \Rightarrow polyline edges
- ▶ Vertices and bends located on a grid

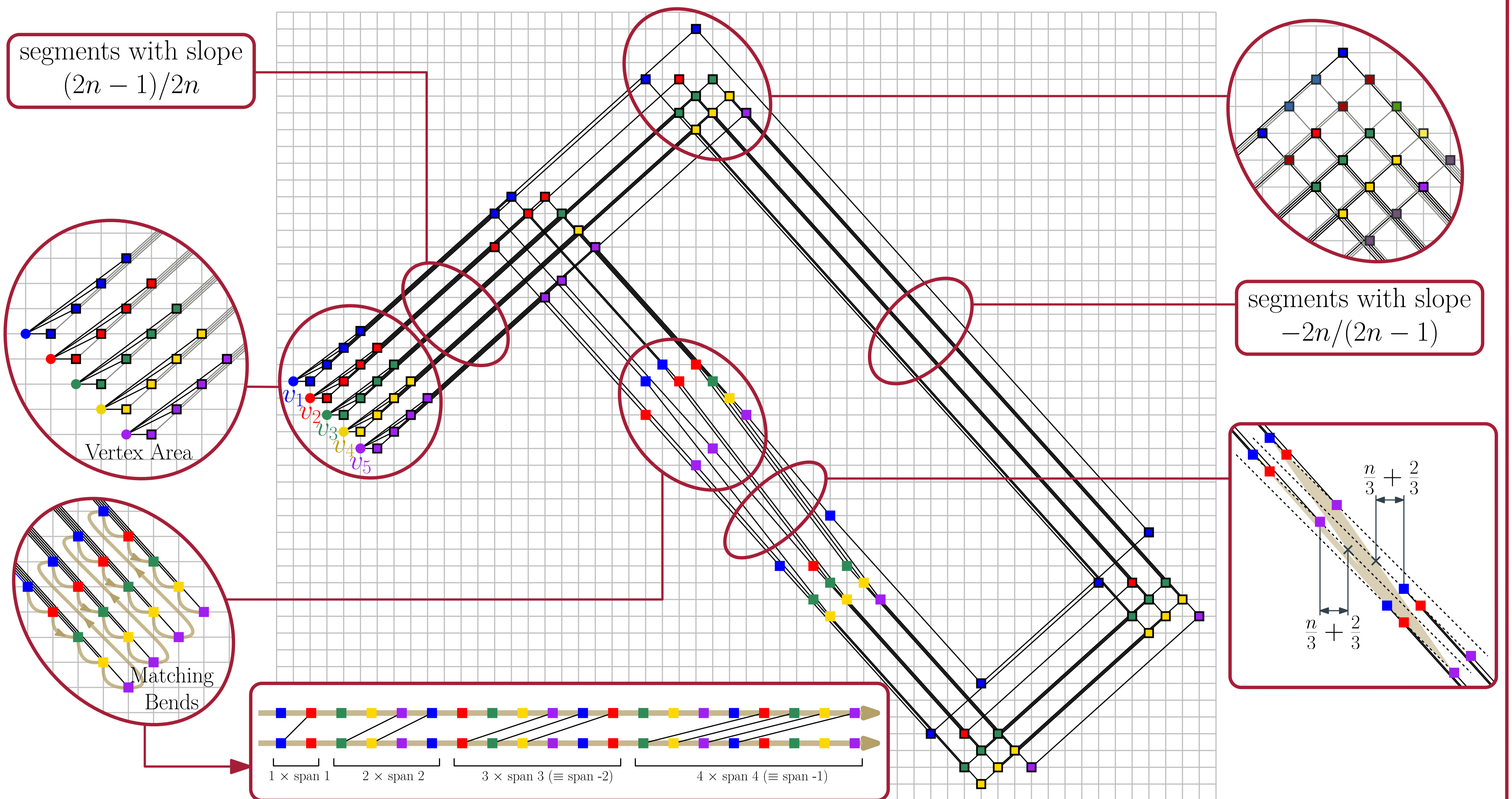
Previous Work

- ▶ Crossing angles affect readability [1,2]
- ▶ Drawings with at most two bends per edge have only $\mathcal{O}(n)$ edges [3,4,5]
- ▶ Every graph has a RAC drawing with three bends in $\mathcal{O}(n^4)$ area [2]
- ▶ Every graph has a RAC drawing with four bends in $\mathcal{O}(n^3)$ area [6]

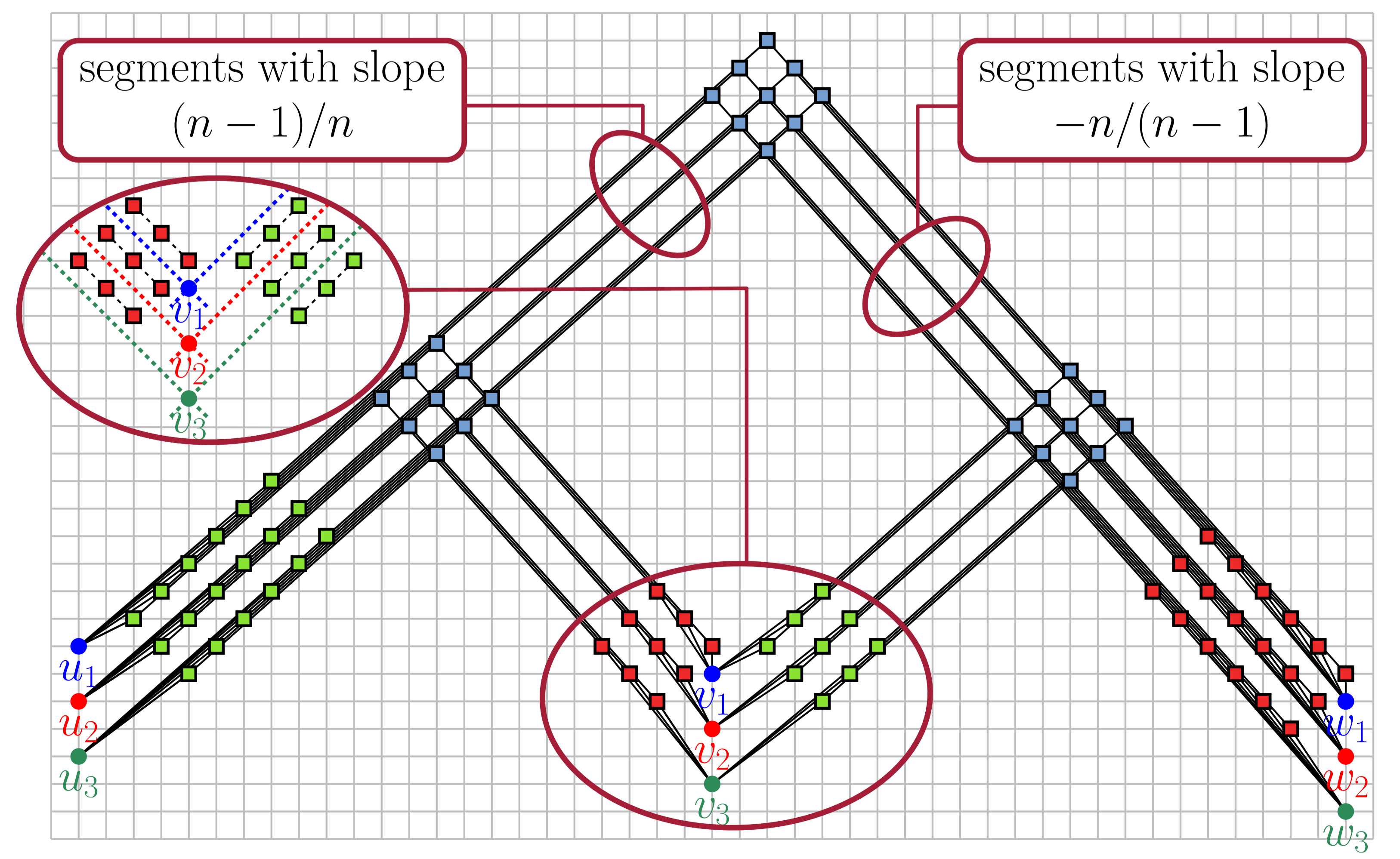
Theorem 1: Every simple graph on n vertices admits a RAC drawing with three bends per edge in $\mathcal{O}(n^3)$ area.



Theorem 2: Every simple graph on n vertices admits a RAC drawing with eight bends per edge in $\mathcal{O}(n^2)$ area.



Theorem 3: Every simple k -partite graph on n vertices admits a RAC drawing with three bends per edge in $\mathcal{O}(k^2 n^2)$ area.



Theorem 4: There exists no RAC drawing of K_n with three bends per edge in $\mathcal{O}(n^2)$ area for $n \geq n_0$.

- ▶ **Sketch:** Majority of crossings on long segments with few slopes
- ▶ Vertices must be incident to long segments with few crossings
- ▶ $\Rightarrow \Omega(n^2)$ segments of length $\mathcal{O}(n)$ are required
- ▶ Segments incident to vertices must be bundled
- ▶ If G is not k -partite, some connections cannot be realized

Open Problems

- ▶ How many bends per edge are needed for quadratic area?
- ▶ Is cubic area optimal for three bends per edge?
- ▶ Is quadratic area achievable with simple RAC drawings?

References

- [1] Huang: Using eye tracking to investigate graph layout effects. APVIS 2007.
- [2] Huang, Eades, Hong: Larger crossing angles make graphs easier to read. J. Vis. Lang. Comput. 25(4), 452-465 (2014).
- [3] Didimo, Eades, Liotta: Drawing graphs with right angle crossings. Theor. Comput. Sci. 412(39), 5156-5166 (2011).
- [4] Arikushi, Fulek, Keszegh, Moric, Toth: Graphs that admit right angle crossing drawings. Comput. Geom. 45(4), 169-177 (2012).
- [5] Angelini, Bekos, Förster, Kaufmann: On RAC drawings of graphs with one bend per edge. GD2018.
- [6] Di Giacomo, Didimo, Liotta, Meijer: Area, curve complexity, and crossing resolution of non-planar graph drawings. Theory Comput. Syst. 49(3), 565-575 (2011).