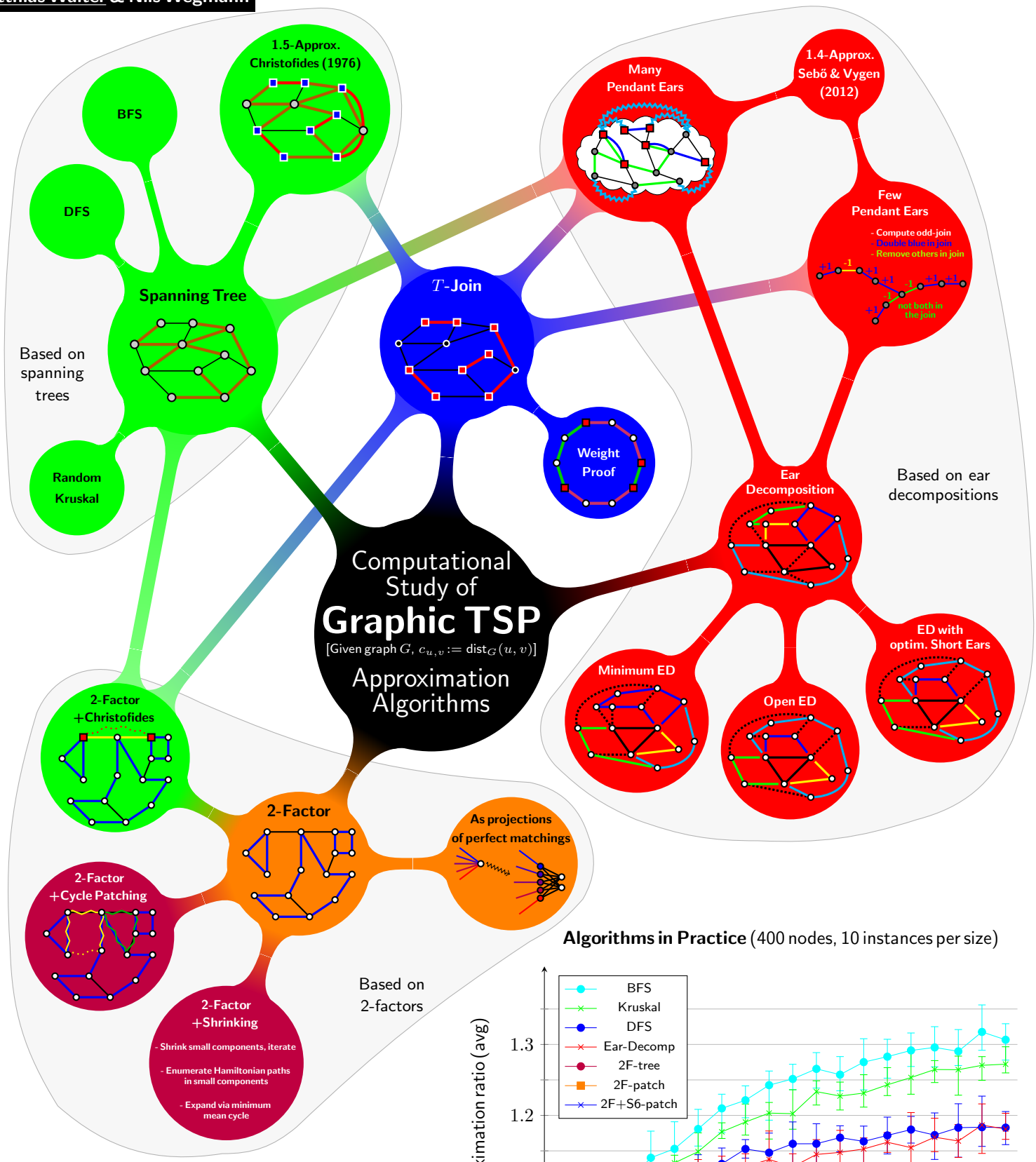
Matthias Walter & Nils Wegmann

Computational Study of Graphic TSP

[Given graph G, $c_{u,v} := \text{dist}_G(u,v)$]

Approximation Algorithms



Exact solutions obtained using **SCIP** and **LEMON**:

$$\min \sum_{e \in 2E} c_e x_e$$

$$\begin{aligned}
\text{s.t.} \quad x(\delta(U)) &\geq 2 && \forall U \subsetneq V \text{ with } U \neq \emptyset \\
x(\delta(U)) - 2x(F) &\geq 1 - |F| && \forall U \subsetneq V, F \subseteq \delta(U), |F| \text{ odd} \\
x_{e_1} &\leq x_{e_2} && \forall e \in E \\
x_e &\in \{0,1\} && \forall e \in 2E
\end{aligned}$$

Algorithms in Practice (400 nodes, 10 instances per size)

Literature:

- Christofides: *Worst-case analysis of a new heuristic for the travelling salesman problem.* CMU Report, '76
- Lovász & Plummer: *Matching Theory.* AMS, '86
- Frank: *Conservative weightings and ear-decompositions of graphs.* Combinatorica, '93
- Papadimitriou & Yannakakis: *The Traveling Salesman Problem with Distances One and Two.* Math. Op. Res., '93
- Achterberg: *SCIP: solving constraint integer programs.* MPC, '09+
- Sebő & Vygen: *Shorter tours by nicer ears: 7/5-approximation for the graph-TSP,[...].* Combinatorica, '14+
- *LEMON: A C++ Library for Efficient Modelling and Optimization in Networks.* lemon.cs.elte.hu, '14

OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG
MATH FACULTY OF MATHEMATICS