Investigating Polyhedra by Oracles

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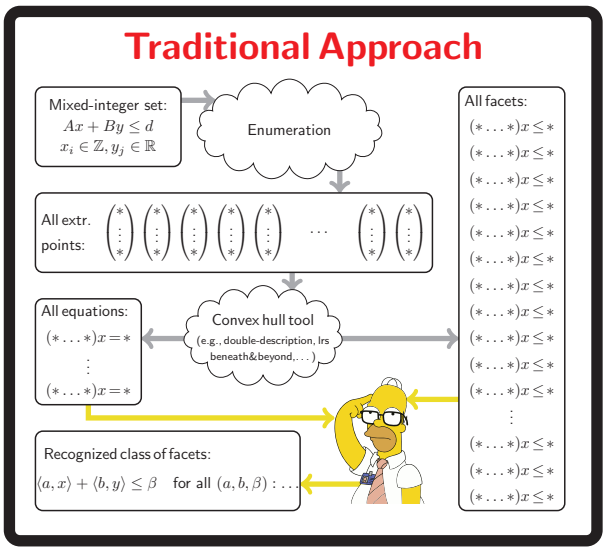
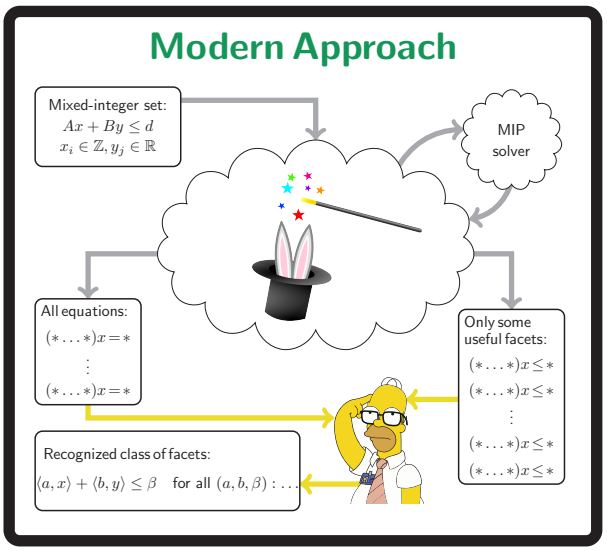
Traditional Approach



Modern Approach



Facts

At most $2n$ queries

Thm.: This is best possible!

Which dimension has P?

Affine hull

Find system of valid equations!

Investigating

Facets

$\max \hat{x}^\intercal a - \beta$
s.t. $x^\intercal a \leq \beta \quad \forall x \in P$
$(\hat{x} - o)^\intercal a \leq 1 + \beta$
$a \in \mathbb{R}^n, \beta \in \mathbb{R}$

$[o \in \text{relint}(P)]$

Separate $\hat{x}$ by a facet!

Separate objective-based!

Projections

Polyhedra

Recession cone

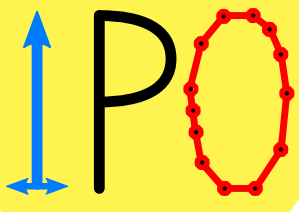
Faces

(1) Oracle for normal cone C at $\hat{x}$ (2) Affine hull yields $c \in \text{relint} C$, def. the face

Smallest face that contains $\hat{x}$

Are u and v adjacent?

Is $\hat{x}$ a vertex?



IP

LP-relaxation
Integer hull

by Oracles

Included

ExactSCIP
SCIP

Auxiliary

– Solution cache
– Heuristics

Interfaces

Python
C++