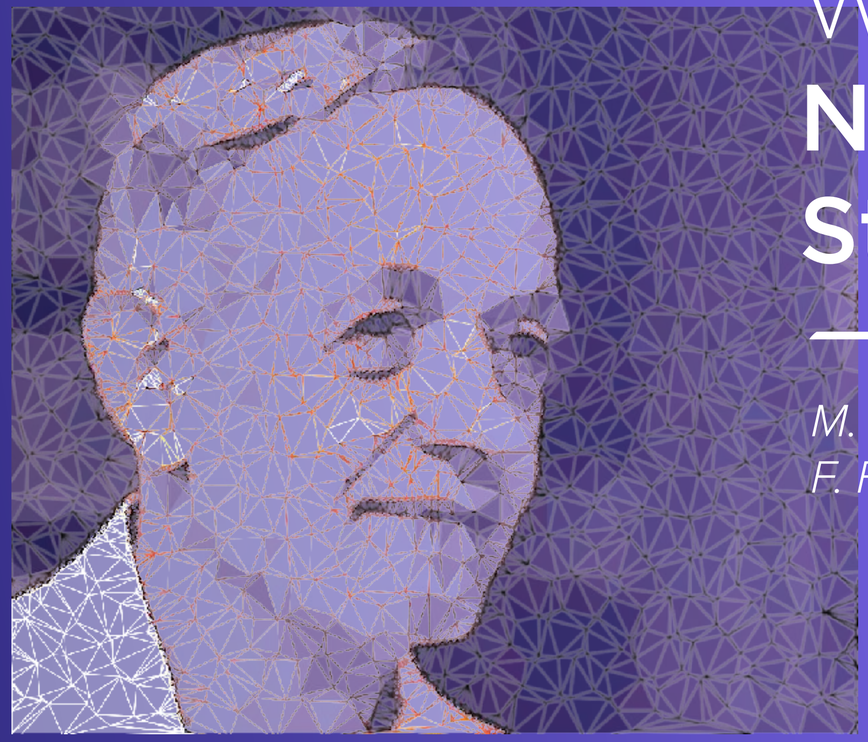

When Nash meets Stackelberg: **Nash Games Among Stackelberg Leaders**

M. Carvalho, ***G. Dragotto,***
F. Feijoo, A. Lodi, S. Sankaranarayanan

CANADA EXCELLENCE RESEARCH CHAIR
DATA SCIENCE FOR REAL-TIME DECISION-MAKING
POLYTECHNIQUE MONTRÉAL
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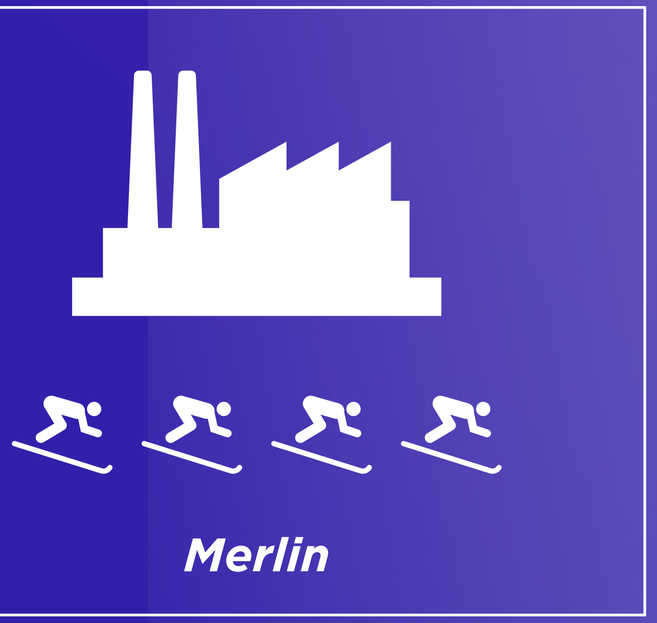
Energy Applications

Connections to Pascal’s and Dorothee’s talks

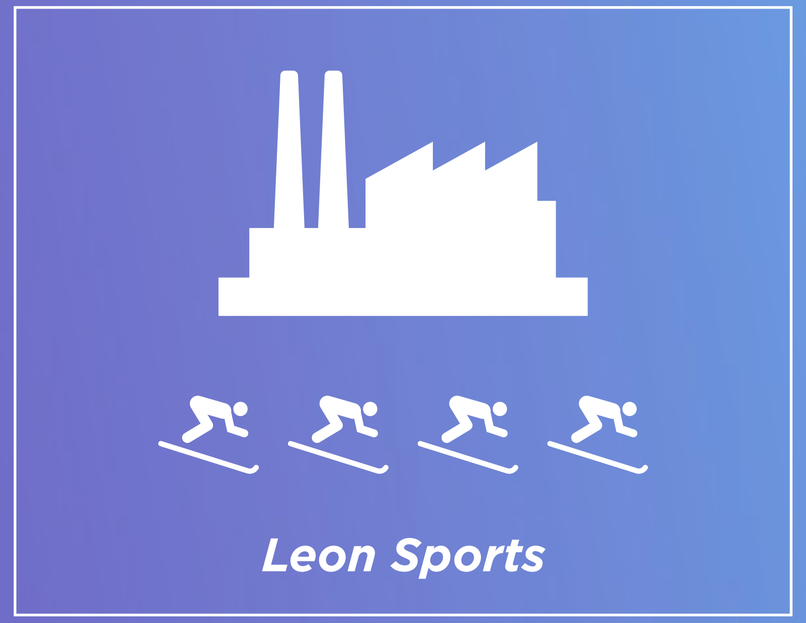
Consider a ***Ski*** shop

Merlin

sells *skis* in a **market** in order to **profit**



Nash Game



And *competes* with ***Leon Sports***

Hence, Leon Sports and Merlin are ***playing a Nash Game***

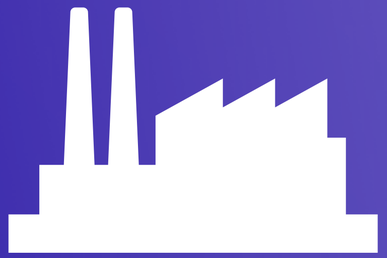
Aussois Ski Resort

taxes and regulates the *ski market*

Nash Game

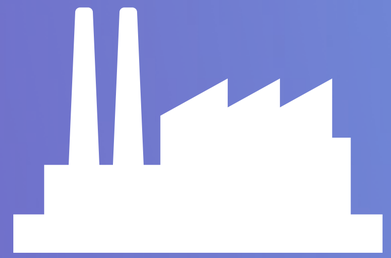
Aussois Ski Resort

Stackelberg Games



Ski Corporation **A**

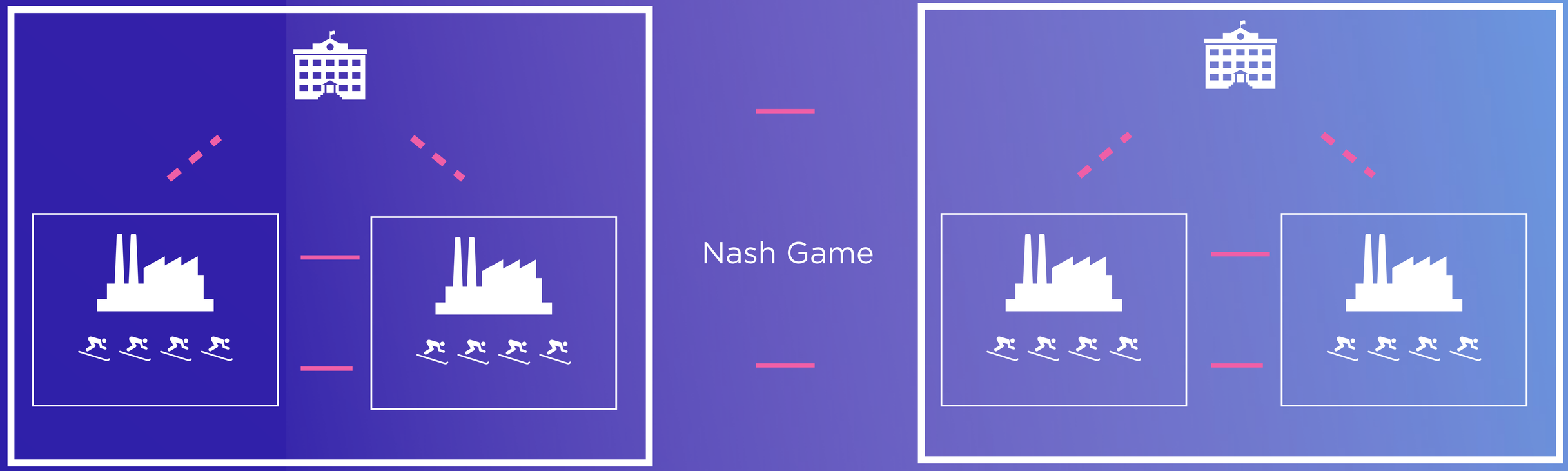
Nash Game



Ski Corporation **B**

Aussois Ski Resort

Plays a ***Stackelberg*** game with Ski-Rentals



Aussois Ski Resort trades skis and competes with **Bardonecchia**

We call this a Nash Game Among Stackelberg Leaders (***NASP***)

Were do we stand

Theorem *(Carvalho, D., Feijoo, Lodi, Sankaranarayanan, 2019)*

*Given a (trivial) NASP with **2 leaders** and **1 follower** each, where the **followers** solve a* **linear program** *and the **leaders** have **linear objectives**:*

1. It is Σ_2^p-hard to decide if the problem has a **Mixed Nash Equilibrium,** and
2. It is Σ_2^p-hard to decide if the problem has a **Pure-Strategy Nash Equilibrium** even if all feasible regions are **bounded.**

🌈 **There is still hope!**

NASPs have a well-defined ***polyhedral structure***

Even though ***non-convex***, we can use *Balas'* clconv to ***"convexify"***

We have a 🎒 ***full of algorithmic tools*** for *finding equilibria with guarantees/certificates*

Convexification *in a* ***Game Theoretic context***

MNE *over the* ***convex-hull*** *=* ***MNE*** *for the* ***original*** *game!*

Let’s talk about this 🙂

When Nash Meets Stackelberg

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