# SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT

**The STSM applicant submits this report for approval to the STSM coordinator**

**Action number: CA16228**
**STSM title: Search game on a dynamic network, with Pr. Marco Scarsini**
**STSM start and end date: 13/04/2018 to 30/04/2018**
**Grantee name: Tristan Garrec**

## PURPOSE OF THE STSM

In a search game, two players, the searcher and the hider, act on a graph. The searcher intends to minimize the time needed to locate the mobile or immobile hider. The literature on search games is vast and several variants have been studied.

Our work with Pr. Scarsini consists in analyzing a situation in which the underlying graph evolves randomly with time. At each stage, every edge in the graph is, independently of the others and of previous stages, active or inactive with a certain probability. This variant, we call "Stochastic Search games", has never been studied before.

## DESCRIPTION OF WORK CARRIED OUT DURING THE STSM

We focused our attention on two classes of graphs: stars and binary trees. In these graphs, we studied the class of depth-first strategies of the hider and the equal branching density of the searcher in order to understand when equilibrium strategies belong to those classes. Running numerical experiments also helped us better understand which strategies are optimal when depth-first strategies and the equal branching density are not.

During my stay I also gave a talk entitled "Stochastic Search Games" at the Università di Roma La Sapienza on the occasion of the workshop Roman Games 2 organized by Francisco Facchinei and Roberto Lucchetti.

## DESCRIPTION OF THE MAIN RESULTS OBTAINED

- Complete resolution (value and optimal strategies) of several particular cases,
- Upper bound on the value of the game given by the biased depth-first strategy,
- Value and a couple of optimal strategies when depth-first strategies are best responses to the equal branching density,

- Asymptotic equivalent of the value for star graphs as the activation parameter goes to zero.

**<u>FUTURE COLLABORATIONS</u>**

Pr. Scarsini and I plan to continue our study of stochastic search games, in particular when the activation parameter is in a neighbourhood of zero or one.