Emergent phenomena in complex systems recently became a very relevant, fascinating and strongly multidisciplinary field of research. Understanding, modelling and quantifying the complexity of biological, economical and industrial systems, estimating the risks or exploiting potential, often unexpected benefits of their emergent large-scale behaviour (safety and reliability vs efficiency and productivity) proved to be a non-trivial and highly impactful area of scientific interest. In this talk we introduce a construction of a gauge field theory of complex adaptive systems based on a suitable simplicial formulation of discrete differential geometry. The main idea is adapting and applying standard concepts of the theory of geometric structures over differentiable manifolds (principal and associated bundles) to model complexity. Suitably defined discrete analogues of local geometric obstructions and global topological obstructions (characteristic classes) that impede fibre bundles to be trivial, play crucial role in our construction.
Two industrial examples in which this geometric viewpoint on complex systems proved to be very efficient will be briefly introduced.