Journée Georges de Rham
Wednesday, March 8, 2017
EPFL — Room CO2

15:20–15:30 Opening and Welcome

15:30–16:30 Stéphane Mallat (Ecole Normale Supérieure)
Mathematical Mysteries of Deep Networks

Deep convolutional networks provide state of the art classification and regression results over many high-dimensional problems including image, audio bio-medical signal recognition, with spectacular results. They are able to approximate high-dimensional functionals without suffering from the curse of dimensionality.

We shall review their architecture and concentrate on the analysis of their mathematical properties, which are mostly not understood. Applications will be shown for image and audio processing, but also to approximate complex stochastic processes for statistical physics, and quantum chemistry.

16:30–17:15 Coffee Break

17:15–18:15 Sergei Tabachnikov (Pennsylvania State University)
Flavors of Bicycle Mathematics

We consider a naive model of bicycle motion: a bicycle is a segment of fixed length that can move so that the velocity of the rear end is always aligned with the segment. Surprisingly, this simple model is quite rich. Three problems will be discussed:
1) The monodromy map of the front wheel: this problem is connected with Möbius transformations, and we will outline the proof of a 100 year old problem related to hyperbolicity.
2) The relation between the two front wheel tracks obtained by going in both directions, fixing the rear wheel track: this defines a completely integrable dynamical system.
3) The description of the pairs of rear and front tracks of a bicycle with an ambiguous direction: this is an open problem, intimately related with Ulam’s problem in flotation theory.

19:30 Dinner At Gina

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