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AI for physical models with geometric tools

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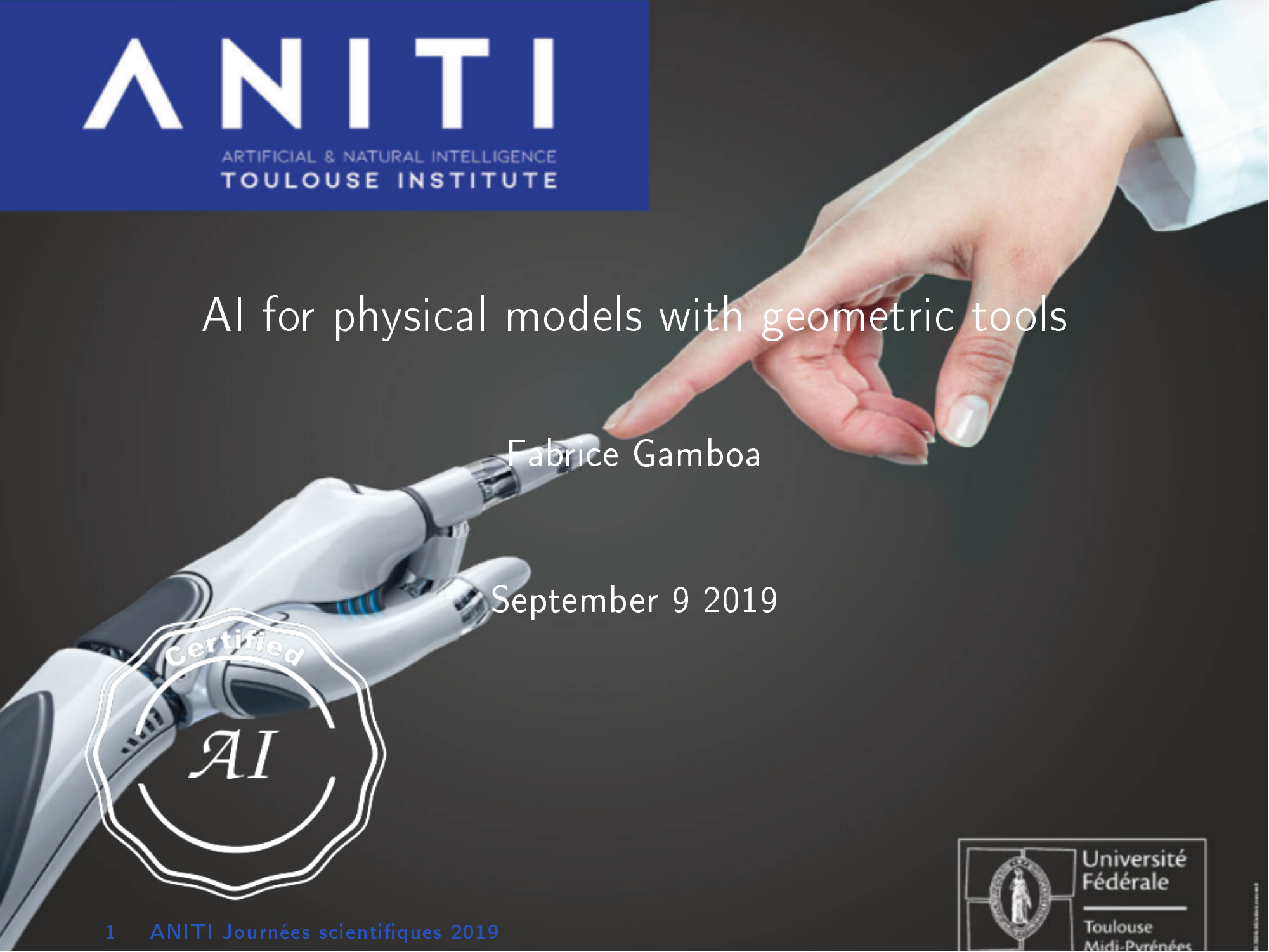

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Agenda

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Chair members

Context

Objective

Outline

Chair members

- Fabrice Gamboa (PR IMT UPS-Applied Mathematics-)
  - Habilitation 1994
  - Research: Applied Probability, Math and Applied Statistics
  - Deputy Director UMI CNRS IFCAM (France-India)

Chair members

- Reda Chhaibi (MCF IMT UPS-Pure Mathematics-)
  - X 2008-Ph D 2013
  - Research: Probability, Algebra and Geometry

Chair members

- Thomas Pellegrini (MCF IRIT UPS-Computer Science-)
  - ESPCI 2004-Ph D 2008
  - Research: Deep learning and Deep Neural Networks for Signal Applications

Context

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The chair is at the crossroad of

- Computer Code Experiments
- Statistical Learning
- Geometry

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What are Computer Code Experiments?

- Black Box model modelling a Physical model (meteo, chemestry,...) Involving complicated math model (PDE, integration, Monte Carlo,...)
- $Y = F(X)$. Y is the output X is the input (scenario) both could be image, signal, vector, ...
- Computer Code Experiments= Statistical methods to understand better F (Sensitivity of the inputs, metamodeling, optimization,...)

What is Statistical Learning?

- Observed Sample (supervised) (Y_i, X_i) or only (unsupervised) (X_i) $(i = 1, \dots N)$. Y is the response X is the observation (scenario) both could be image, signal, vector, ...
- Wish to build $\widehat{F}$ with $Y \approx \widehat{F}(X)$.
- Neural Networks, Regression Trees, Kernel Methods ...

Objective

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- Put in action and adapt to statistical learning tools from computer code experiments. Example: senstivity analysis enlights explainabilty (link with the chair supported by JM Loubes)
- Put in action hybrid strategies F, $\widehat{F}$ to speed up the computations. Example: SAFRAN turbine profiling and neural computing
- Use smart encoding geometries to feed sample (X, Y) for efficient learning. Examples Verblunsky coefficients, Riemannian barycenters, ...
- Use geometry tools to understand and explain $\widehat{F}$. Examples Neural Nets, Methods based on Optimal Transport,...

Outline

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- Chalenging hot topics: Geometry for AI and Statistical learning
- Eclectic team, from pure mathematics to computer sciences
- Strong interactions with industry: SAFRAN, CONTINENTAl, RENAULT, ...
- Strong interactions with the chairs of JM Loubes (IMT) and S. Gratton (IRIT)

END

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Thanks for your attention

Merci Gracias Obrigado Grazie Спасибо