Lecture 1: Introduction to Predictive Modeling

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Aleatory vs epistemic uncertainty

Types of uncertainty

- **Aleatory**: naturally occurring randomness that we cannot (or do not know how to) reduce.

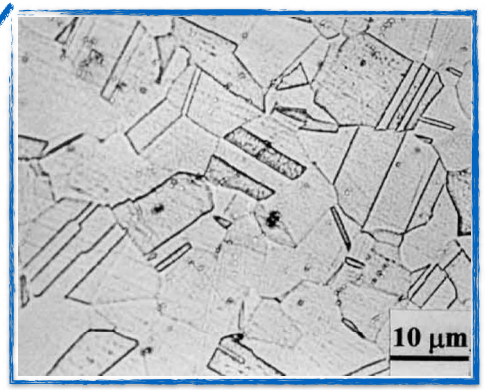
  Latin aleatorius of a gambler, from aleator gambler, from alea a dice game

- **Epistemic**: uncertainty due to lack of knowledge that we can reduce by paying a price. (ie, running an experiment)

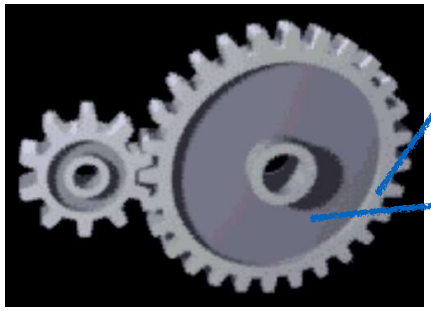
  Greek επιστήμη meaning knowledge.

Unknown microstructure of a manufactured artifact

image will be different each time: aleatory



https://commons.wikimedia.org/wiki/File:Microstructure_of_a_unsensitised_type_304_stainless_steel.jpg
(https://creativecommons.org/licenses/by-sa/3.0)



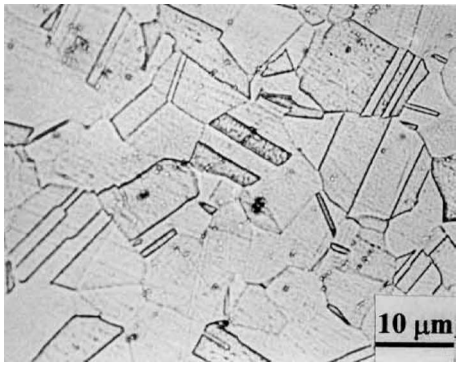
https://www.osha.gov/SLTC/etools/machineguarding/animations/gears.html

microstructure of particular gear is epistemic (known once measured)

We model uncertainties using probability

$p(A \mid K)$ = "How much do we believe A is true given our current state of knowledge K"

can be applied to both types of uncertainty

p(

|K)=?