



Cornell Bowers C-IS
College of Computing and Information Science



Non-Determinism and the Lawlessness of Machine Learning Code

A. Feder Cooper, Jonathan Frankle, and Chris De Sa

The cyberlaw frame

“Code is law” (Reidenberg, Lessig)

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Machine learning (ML) code is **non**-*deterministic*

our paper gets into this in detail

A brief tour of this talk

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2. Relating prior legal literature on ML stochasticity

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3. Clarifying the effects of non-determinism by reasoning about *distributions over outcomes*

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2. Relating prior legal literature on ML stochasticity
3. Clarifying the effects of non-determinism by reasoning about *distributions over outcomes*
4. Breaking the cyberlaw “code is law” frame with non-deterministic ML code

Non-determinism and stochasticity

Non-determinism

A property of processes for which supplying the same inputs can produce different outputs.

Non-determinism and stochasticity

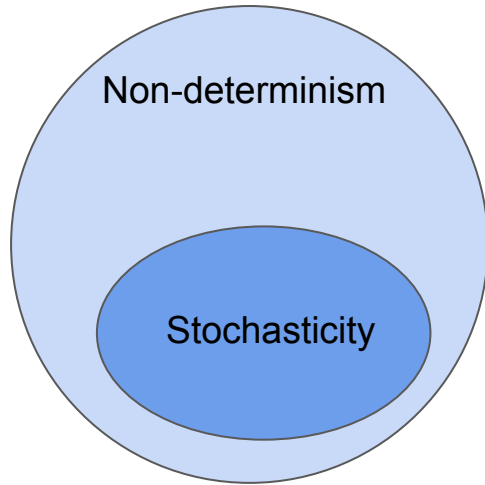
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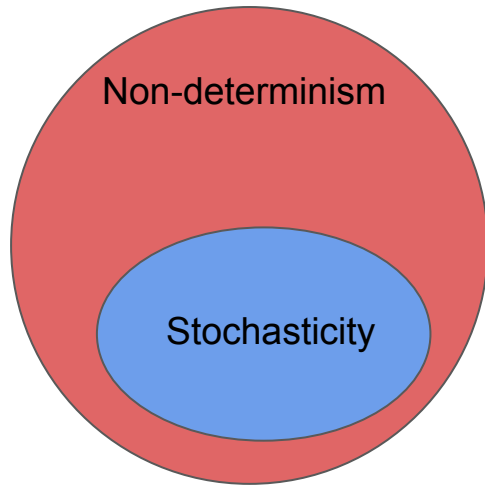
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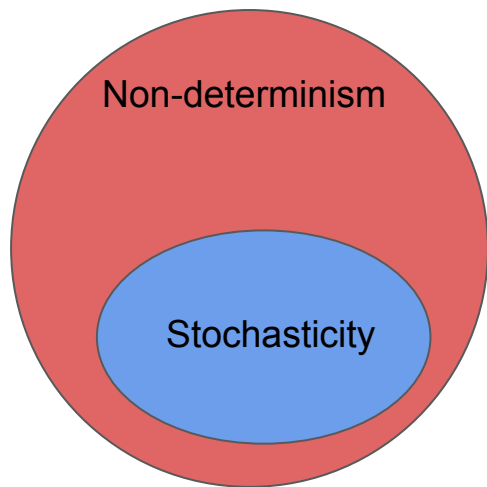
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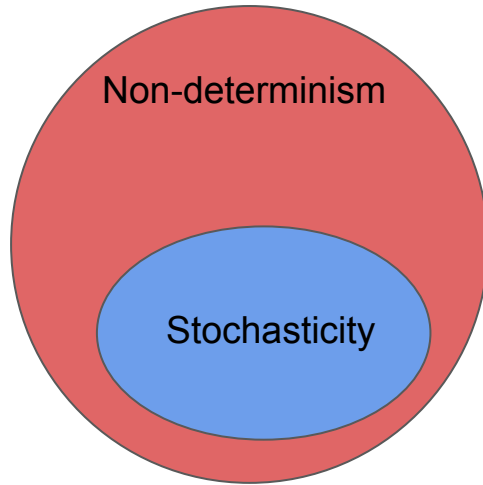
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Existing popular ML frameworks
(e.g., PyTorch)

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Existing legal
literature

ML stochasticity in the legal literature

In a **single model**, stochasticity can cause the **deterministic decision rule**

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Arbitrariness in ML (Creel and Hellman)

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What about **non**-stochastic non-determinism?

Reasoning about *distributions over outcomes*

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We will think about **distributions**

over **possible models** with different **deterministic decision rules**

(where the distribution of rules is influenced by multiple types of non-determinism in training)

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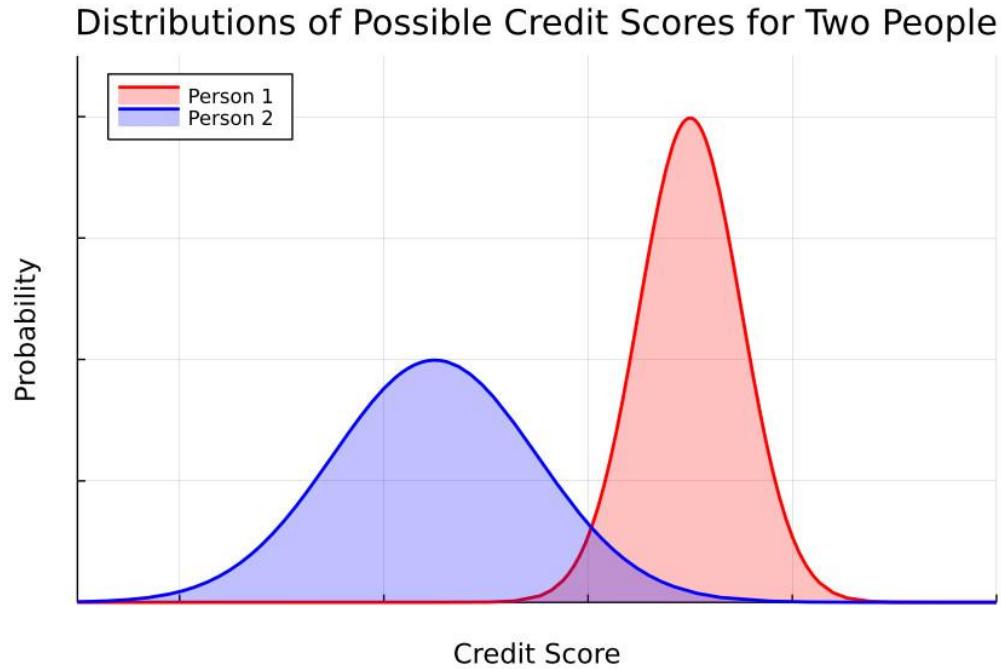
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Taking a distributional approach

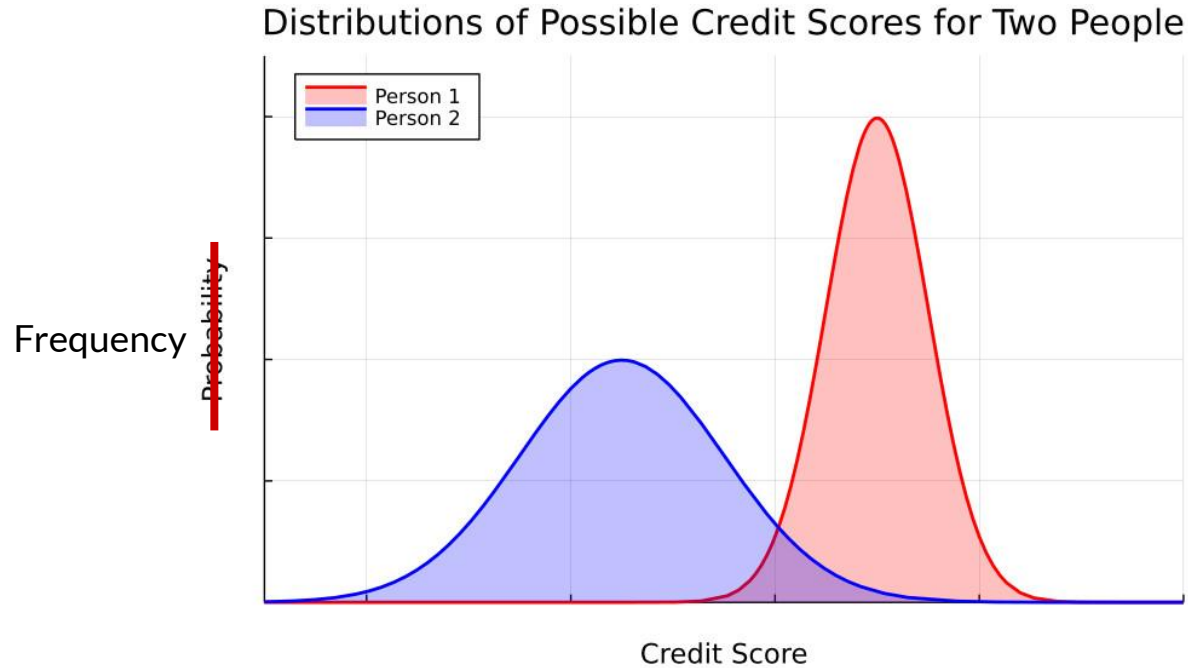
1. Clarifies prior scholarship on stochasticity
2. Accounts for other types of non-determinism

Ex. 1: Distributions over Individual Outcomes



A distributional view of stochasticity

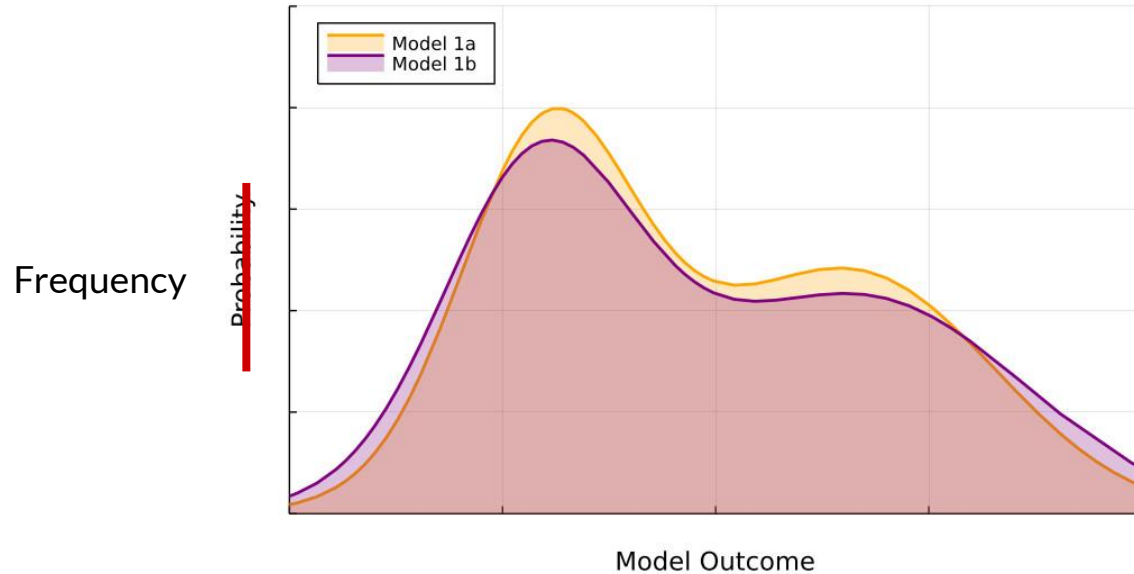
Ex. 1: Distributions over Individual Outcomes



**A distributional view of non-stochastic
non-determinism**

Ex. 2: Distributions over Models

Distribution of Model Outcomes for Two Similar Models



**A distributional view of non-stochastic
non-determinism**

Takeaways from these examples

Reasoning about distributions over outcomes clarifies the importance of non-determinism

Non-stochastic non-determinism also has important normative effects on ML outcomes

Non-deterministic code is lawless

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Non-stochastic non-determinism can cause **contradictions** and is **unpredictable**

Takeaways and other work

The law can take care to reason about **distributions over outcomes**, to expose the effects of different types of non-determinism

ML can develop more precise tools to reason about different types of arbitrariness and to mitigate its impacts



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Thank you!