Legal Probabilism and Its Limits

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Contents

Part I

What is legal probabilism?

Chapter 1

The emergence of legal probabilism

This chapter will introduce legal probabilism and contain an account of early discussions of legal probabilism, how it came about, when, major contributions, etc. I see essentially two moments in the history of legal probabilism: the early days when probability theory was invented (Bernoulli, Laplace, Condorcet, etc.), and then the second half of the 20th century with the emergence of the New Evidence Scholarship (Lempert) and law and economics. But the history might be more complicated.

Chapter 2

A skeptical perspective

This chapter would discuss puzzles and hypothetical scenarios, mostly the debate about naked statistical evidence. This is a discussion of the most compelling objections that have been raised against legal probabilism. Most of these objections trace back to Cohen, although other pivotal players are Laurence Tribe and Ronald Allen. I think this chapter could also have a historical flavor or perhaps it could be more systematic. Not sure about the best presentation format.

2.1 The difficulty about conjunction

2.2 The complexity objection

2.3 The problem of corroboration

2.4 The problem of artificial precision

2.5 Naked statistical evidence

2.6 The problem of priors

2.7 The reference class problem

2.8 Non-probabilistic perspectives

Part II

Evidence assessment

After the first part, the rest of the book will be a deep dive into what probability theory can do for us when it is applied to trial proceedings.

Instead of addressing the common objections upfront, the strategy of the book would be to set the objections aside – keep them on the back burner as it were – and return to them once we have a clearer sense of legal probabilism and its limits.

We need to clearly set the limit of discussion of objections in the first part

This part of the book is devoted to how probability theory can help—or not help—in assessing trial evidence. I think it is important that we start very simple and then we progressively get more complex.

Chapter 3

Bayes' Theorem and the usual fallacies

This chapter shows how we can use probability theory and Bayes' theory to spot common probabilistic fallacies, prosecutor's fallacy, base rate fallacy, etc. This is the simple stuff.

I think this chapter should also show the limitation of this approach. That is, we should make clear that these are probabilistic fallacies. They are fallacies only insofar as the trier of facts aim to determine the posterior probability of guilt. Which they might not.

careful here, some come up without explicit calculations

The chapter will also be accompanied by case studies.

3.1 Assuming independence

3.2 The prosecutor's fallacy

3.3 Base rate fallacy

3.4 Defense attorney's fallacy

3.5 Uniqueness fallacy

3.6 Case studies

3.6.1 Collins

3.6.2 Sally Clark

Chapter 4

Complications and caveats

not sure if this isn't too early

Here we examine a number of complications that emerge from the simple Bayes' theorem approach described in the earlier chapter. Here are some of the common difficulties:

- How do we determine the priors?
- More generally, how do we determine the numerical values of any of the probabilities involved? It might work for DNA matches, but what about non0numerical evidence such as eyewitnesses?
- How do we combine different pieces of evidence?
- How we we formulate complex hypotheses, say narratives, stories or explanations?
- How do we take into account things like the coherence of one's story or the explanatory power of one's hypothesis? (evidence-to-hypothesis reasoning versus hypothesis-to-evidence reasoning).
- Ronald Allen's objections and Susan Haack's objections.

4.1 Complex hypotheses and complex bodies of evidence

4.2 Source, activity and offense level hypotheses

4.3 Where do the numbers come from?

4.4 Modeling corroboration

4.5 Stories, explanations and coherence

Chapter 5

Likelihood Ratios and Relevance

Here we present likelihood ratios as a possible answer to some of the complications. Pros and cons of this approach. It addresses the problems of priors to some extent, but it leaves a lot of the other complications essentially unresolved. The likelihood approach raises complication of its own.

5.1 Odds version of Bayes' theorem

5.2 Bayesian factor v. likelihood ratio

5.3 Choosing competing hypotheses

5.4 The two-stain problem

5.5 Case study: cold-hit DNA match evaluation

Chapter 6

Bayesian Networks

Here we present Bayesian networks as the best answer that legal probabilists can offer. We illustrate Bayesian networks with examples and show how they can answer some of the complications. We try to be as honest as possible. We want to be a reliable and trustworthy source of discussion, not partisan. We also discuss how Bayesian networks can help address certain puzzles about relevance.

6.1 Bayesian networks to the rescue

6.2 Legal evidence idioms

6.3 Scenario idioms

6.4 Modeling relevance

6.5 Case study: Sally Clark

Do we really want to get into BNs for DNA evidence evaluation?

6.6 DNA evidence

We already mention corroboration at two places, we should clean this up.

Chapter 7

Corroboration

Here we zoom into a particular topic. This should be a place to review the literature on corroboration and for Rafal to present his own probabilistic solution to the corroboration puzzle.

Use BNs in the exposition!

7.1 Boole's formula and Cohen's challenge

7.2 Modeling substantial rise in case of agreement

7.3 Ekelöf's corroboration measure and evidentiary mechanisms

7.4 General approach with multiple false stories and multiple witnesses

Chapter 8

Coherence

Looks like coherence (cohesiveness and related ideas) plays an important role in assessing evidence at trial. Here it would be place to review the literature on coherence and for Rafal to preset his own probabilistic solution to the coherence puzzle, emphasizing legal applications.

8.1 Existing probabilistic coherence measures

8.2 An array of counterexamples

8.3 Coherence of structured narrations with Bayesian networks

8.4 Application to legal cases

Chapter 9

New legal probabilism

9.1 Desiderata

9.2 A probabilistic framework for narrations

9.3 Probabilistic explications of the desiderata

9.4 Bayesian network implementation

perhaps Allen, Haack & Moss here?

- The Dutch school and its challenges
- Merging/aggregation/selection issues
- Conditions on narration
- Formal representation and programmatic deployment

Part III

Trial Decisions

We turn from assessing evidence to trial decisions. The question is this, when is the evidence strong enough to meet the governing burden of proof?

Chapter 10

Standards of proof

10.1 Legal background

10.2 Probabilistic thresholds

10.3 Theoretical difficultiies

10.4 Likelihood approach

10.5 The difficulties perist

10.6 Bayesian networks and probabilistic standard of proof

Chapter 11

The functions of the proof standards

11.1 Protecting defendants

(re Winship)

11.2 Error reduction and error distribution/allocation

(Laudan, Stein, Allen)

11.3 Dispute resolution and public deference

(Nesson)

11.4 Justification and answerability

(Duff)

11.5 How probability theory can help

Chapter 12

Accuracy and the risk of error

This chapter introduces different ways to think about the risk of error at trial.

12.1 Minimizing expected costs

Thisreviews the literature that describes how expected utility can be used to define rules for trial decisions.

12.2 Minimizing expected errors

12.3 Expected v. actual errors

12.4 Competing accounts of the risk of error

One dimension of the risk of error flows from the posterior probabilities $P(Guilt|Evidence)$. The other dimension flows from the conditional probabilities $P(Conviction|Innocence)$. This an opportunity for Marcello to present the arguments in his Mind paper, which however Rafal has criticized. So hopefully this chapter will be a very balanced account of the topic!

12.5 Bayesian networks and the risk of error

Chapter 13

Fairness in trial decisions

This chapter discusses how decisions can be fair and to what extent probability theory can help us think about the fairness of decisions. One important notion of fairness that probability theory can capture is that of equal distribution of the risk of error. This draws on some of Marcello's argument in the Ethics paper.

talk about incompatibility of definitions, Hedden's argument against measures of fairness etc.

13.1 Procedural v. substantive fairness

13.2 Competing measures of substantive fairness

13.3 Bayesian networks and fairnesss

Part IV

Comparisons

Chapter 14

Alternative accounts

There exist several theoretical alternatives to the probabilistic interpretation of proof standards in the scholarly literature. Some scholars, on empirical or normative grounds, resist the claim that the point of gathering and assessing evidence at trial is solely to estimate the probability of the defendant's civil or criminal liability.

14.1 Baconian probability

This is Cohen's stuff, also followed by Alex Stein. (Stein, 2008) argues that, in order to warrant a verdict against the defendant, the evidence should have withstood objections and counterarguments, not merely supporting a high probability.

14.2 Relative Plausibility

(Pennington & Hastie, 1991, Pennington & Hastie (1993)) have proposed the *story model* according to which judges and jurors, first make sense of the evidence by constructing stories of what happened, and then select the best story on the basis of multiple criteria, such as coherence, fit with the evidence and completeness. Along similar lines, (**???**) argue that the version of the facts that best explains the evidence should prevail in a court of law. For a discussion of inference to the best explanation in legal reasoning, see (Schwartz & Sober, 2019, Hastie (2019), Ho (2019), Dale A Nance (2019)).

14.3 Arguments

Another approach is due to (Gordon, Prakken, & Walton, 2007) and (Prakken & Sartor, 2009) who view the trial as a place in which arguments and counterarguments confront one another. The party that has the best arguments, all things considered, should prevail. On this view, probability estimates can themselves be the target of objections and counterarguments.

14.4 Relevant alternatives

(Gardiner, 2019) argues that standards of proof should rule out all error possibilities that are relevant and these need not coincide with error possibilities that are probable.

14.5 Normic Support

Martin Smith approach.

14.6 Justification/foundherentism

(Ho, 2008) and (Haack, 2014) hold that degrees of epistemic warrant for a claim, which depend on multiple factors – such as the extent to which the evidence supports the claim and it is comprehensive – cannot be equated to probabilities.

14.7 Completeness

Discuss here Nance proposal. (Dale A. Nance, 2016) argues that the evidence on which to base a trial decision should be reasonably complete—it should be all the evidence that one would reasonably expect to see from a conscientious investigation of the facts. A similar argument can be found in (Davidson & Pargetter, 1987). Arguably, probability-based decision thresholds can accommodate these considerations, for example, by lowering the probability of civil or criminal liability whenever the body of evidence is one-sided or incomplete (Kaye, 1979, Kaye (1986), Friedman (1996)). Another strategy is to give a probability-based account of the notion of completeness of the evidence and other seemingly non-probabilistic criteria (**???**).

14.8 Knowledge

Some epistemologists argue that a probabilistic belief, no matter how high, is not enough to warrant knowledge, and knowledge should be the standard for trial verdicts.

Chapter 15

Legal probabilism and ...

15.1 ... Baconian probability

15.2 ... relative plausibility

15.3 ... the story model

15.4 .. foundherentism

15.5 ... arguments

15.6 ... relevant alternatives

15.7 ... normic support

15.8 ... knowledge

Chapter 16

Conclusion

I'd like this conclusion to be a very careful and nuanced discussion of the good and bad things about legal probabilism. What difficulties can in principle be overcome and what other difficulties are instead inherent to legal probabilism and thus inescapable?

Preface

testing again

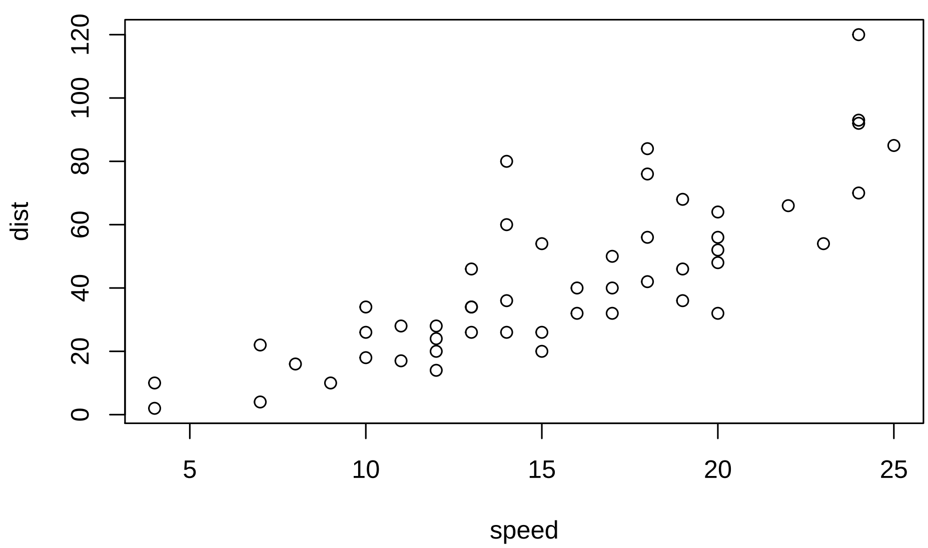
$$f(k) = \binom{n}{k} p^k (1-p)^{n-k} \tag{16.1}$$

This is a citation (Diamond, 1990) which uses keys from the bib file listed in the preamble.

Equation (16.1)[1]

Note that chapter files are found and compiled automatically, but the file names have to contain chapter numbers first. For instance, we used `01-intro.Rmd`, placed in the same folder. Observe how we included r code inline.

```
plot(cars)
```



[1]This is a footnote containing a double citation (Dahlman, 2020; Diamond, 1990).

Chapter 17

Introduction

You can label chapter and section titles using `{#label}` after them, e.g., we can reference Chapter 17. Let's use chapter labels starting with "ch:".

Figures and tables with captions will be placed in `figure` and `table` environments, respectively.

```
par(mar = c(4, 4, .1, .1))
plot(pressure, type = 'b', pch = 19)
```

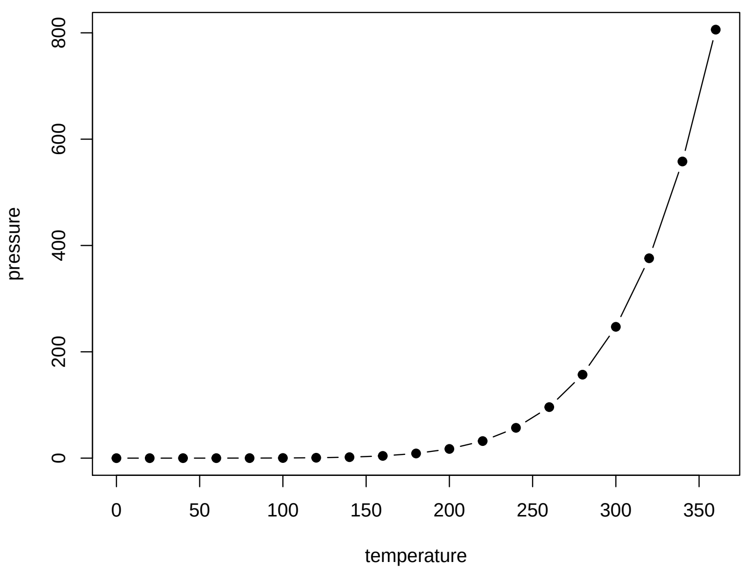


Figure 17.1: Here is a nice figure!

Reference a figure by its code chunk label with the `fig:` prefix, e.g., see Figure

Table 17.1: Here is a nice table!

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.0	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa
4.6	3.4	1.4	0.3	setosa
5.0	3.4	1.5	0.2	setosa
4.4	2.9	1.4	0.2	setosa
4.9	3.1	1.5	0.1	setosa
5.4	3.7	1.5	0.2	setosa
4.8	3.4	1.6	0.2	setosa
4.8	3.0	1.4	0.1	setosa
4.3	3.0	1.1	0.1	setosa
5.8	4.0	1.2	0.2	setosa
5.7	4.4	1.5	0.4	setosa
5.4	3.9	1.3	0.4	setosa
5.1	3.5	1.4	0.3	setosa
5.7	3.8	1.7	0.3	setosa
5.1	3.8	1.5	0.3	setosa

17.1. Similarly, you can reference tables generated from `knitr::kable()`, e.g., see Table 17.1.

```r
knitr::kable(
  head(iris, 20), caption = 'Here is a nice table!',
  booktabs = TRUE
)
```

Dahlman, C. (2020). Naked statistical evidence and incentives for lawful conduct. *International Journal of Evidence and Proof*, *24*(2), 162–179.

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