

Jon Williamson: Classical, Carnapian and objective Bayesian inductive logics

These lectures will introduce and motivate three approaches to inductive logic. First, we will encounter what might be called Classical Inductive Logic, which is essentially due to Wittgenstein. This is a very natural approach to inductive logic, but is deficient in an important respect. Rectifying this deficiency motivated Carnap's programme for inductive logic, an approach anticipated by W.E. Johnson. We shall see that Carnap's programme itself faces a number of apparently insuperable problems. We then turn to the third approach to inductive logic, based on objective Bayesian epistemology, and we shall see how it overcomes some of the difficulties facing the two other approaches.

Jeff Paris: Inductive Logic and Analogy

The heuristic of 'by analogy' is quite frequently employed in informal or uncertain reasoning. For example in 1770 Lagrange proved that every natural number is the sum of 4 squares. By analogy then one might conjecture that every natural number is the sum of 9 cubes. Here 'sum' is the same in both cases, 'square' has been replaced by 'cube' and 2×2 by 3×3 (but not $3 \times 3 \times 3$!). The proof of this conjecture was completed in 1912 by Wieferich and Kempner. But analogy doesn't always work, the answer for 4th powers is 19.

The common use of such analogical arguments however raises the question whether 'by analogy' can in any way be formally justified, or is it simply no better than a guess? Putting it another way, can its use be considered rational or logical?

One context which is specifically aimed at investigating the rational (or logical) assignment of belief, as subjective probability, is Inductive Logic as conceived by Rudolf Carnap, and in particular Pure Inductive Logic (PIL) where any intended semantics or interpretations are stripped away.

In my first lecture then I will provide an introduction to PIL and the three main principles for the rational assignment of probabilities, Symmetry, Relevance and Irrelevance, that currently form its basis. In the second lecture I shall consider a number of possible formulations of 'Analogy' within PIL, as an arguably rational principle, and discuss their success and, more often, failure.

A knowledge of basic Predicate Logic is really a requirement but otherwise I shall endeavor to explain the ideas rather than delve into any particularly technical mathematics.

Niki Pfeifer: Probability, Logic, and Cognition

The topics of this course are located in the intersection of formal epistemology and the psychology of reasoning. The course provides an overview of key experimental findings on how people reason under uncertainty. After a brief history of the psychology of deductive reasoning, I will present the new paradigm psychology of reasoning. The new paradigm is characterized by the use of probabilistic rationality norms to investigate human inference.

Finally, I will discuss how combining the new paradigm psychology of reasoning and formal epistemology gives rise to a new interdisciplinary research agenda.

Gregory Wheeler: An Introduction to the Theory of Lower Previsions

This tutorial will introduce the theory of lower previsions, which is arguably the dominant approach to "imprecise probabilities" to emerge from key contributions made by C.A.B. Smith in the 1960s, Peter Williams and Isaac Levi in the 1970s, and Peter Walley and Teddy Seidenfeld in the 80s and 90s, and Gert de Cooman and his collaborators today. This tutorial will introduce two ways of constructing a lower prevision, the first in terms of credal sets, which are closed convex sets of precise probability models, and the second in terms of sets of gambles that a rational agent regards as desirable. We will cover coherence conditions for both constructions, including coherence conditions for conditional lower previsions, and show how the language of desirable gambles allows one to capture propositional logic, and classical precise probabilities in particular, and linear previsions more generally, as special cases. Time permitting, we will also review a phenomenon called dilation, present a new, general characterization of dilation, and remark on a recent debate over the rationality of dilation and its alleged incompatibility with core Bayesian commitments, such as whether dilation compels a rational decision maker to devalue cost-free information.

Juergen Landes: Maximum Entropy and Inductive Logic

Inductive logicians are interested in drawing inferences under uncertainty. Given some background knowledge, information, evidence and/or presuppositions inductive logicians aim to find (all the) reasonable, rational and/or logical partial inferences one can draw in the present situation.

The first technical step is then to work out all the probability functions which are calibrated to the agent's epistemic state. Given this set of probability functions E , how is one to proceed?

Adopting some member of E is an obvious answer. Inference processes are a well-suited tool to turn a set of probability functions E into a single 'privileged' probability function $P_E \in E$. How strongly then is a logical sentence θ or proposition F supported? Given E , the answer simply is $P_E(\theta)$, respectively $P_E(F)$.

In these two lectures we will be looking at the Maximum Entropy inference process which stands out in the class of inference processes, in many interesting ways. After introducing the basic intuition, I will be discussing the formal definition, properties, justification and application of this inference process.