Scientific Explanation And The Causal Structure Of The World

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long term supply relationships are of crucial importance in industrial organization the present r evolution in information and communication technology such as e business is proof of the increasingly dynamic environment in which firms operate as a result firms have to focus on their core competencies and obtain complementary ones from partner firms to be able to survive this can hardly be realized without having long term supply relationships in the past decades research on strategic alliances the class of interfirm arrangements to which long term supply relationships belong mushroomed many ofthe empirical studies in the alliance literature focus on a single variable that is then explained by a set of independent variables for example for international joint ventures the level of commitment interdependence asymmetry and dedicated investments explains the development of trust by itself there is nothing wrong in this approach on the contrary because of all these studies we now have some knowledge about the reasons why firms enter in alliances and why some alliances are more successful than others in fact one of our first studies also belonged to this research tradition

the philosophical theory of scientific explanation proposed here involves a radically new treatment of causality that accords with the pervasively statistical character of contemporary science wesley c salmon describes three fundamental conceptions of scientific explanation the epistemic modal and ontic he argues that the prevailing view a version of the epistemic conception is untenable and that the modal conception is scientifically out dated significantly revising aspects of his earlier work he defends a causal mechanical theory that is a version of the

ontic conception professor salmon s theory furnishes a robust argument for scientific realism akin to the argument that convinced twentieth century physical scientists of the existence of atoms and molecules to do justice to such notions as irreducibly statistical laws and statistical explanation he offers a novel account of physical randomness the transition from the reviewed view of scientific explanation that explanations are arguments to the causal mechanical model requires fundamental rethinking of basic explanatory concepts

recent arguments concerning the nature of causation in evolutionary theory now often known as the debate between the causalist and statisticalist positions have involved answers to a variety of independent questions definitions of key evolutionary concepts like natural selection fitness and genetic drift causation in multi level systems or the nature of evolutionary explanations among others this element offers a way to disentangle one set of these questions surrounding the causal structure of natural selection doing so allows us to clearly reconstruct the approach that some of these major competing interpretations of evolutionary theory have to this causal structure highlighting particular features of philosophical interest within each further those features concern problems not exclusive to the philosophy of biology connections between them and in two case studies contemporary metaphysics and philosophy of physics demonstrate the potential value of broader collaboration in the understanding of evolution

discovering causal structure artificial intelligence philosophy of science and statistical modeling provides information pertinent to the fundamental aspects of a computer program called tetrad this book discusses the version of the tetrad program which is designed to assist in the search for causal explanations of statistical data or alternative models this text then examines the notion of applying artificial intelligence methods to problems of statistical model specification other chapters consider how the tetrad program can help to find god alternative models where they exist and how it can help detect the existence of important neglected variables this book discusses as well the procedures for specifying a model or models to account for non experimental or quasi experimental data the final chapter presents a description of the format of input files and a description of each command this book is a valuable resource for social scientists and researchers

understanding causal structure is a central task of human cognition causal learning underpins the development of our concepts and categories our intuitive theories and our capacities for planning imagination and inference during the last few years there has been an interdisciplinary revolution in our understanding of learning and reasoning researchers in philosophy psychology and computation have discovered new mechanisms for learning the causal structure of the world this new work provides a rigorous formal basis for theory theories of concepts and cognitive development and moreover the causal learning mechanisms it has uncovered go dramatically beyond the traditional mechanisms of both nativist theories such as modularity theories and empiricist ones such as association or connectionism

the two volume set lnai 14391 and 14392 constitutes the proceedings of the 22nd mexican international conference on artificial intelligence micai 2023 held in yucatán mexico in november 2023 the total of 49 papers presented in these two volumes was carefully reviewed and selected from 115 submissions the proceedings of micai 2023 are published in two volumes the first volume advances in computational intelligence contains 24 papers structured into three sections machine learning computer vision and image processing intelligent systems the second volume advances in soft computing contains 25 papers structured into three sections natural language processing bioinformatics and medical applications robotics and applications

we make use of the logical approach to causality in which a general event structure is interpreted as a logical automaton arising from a particular logic of causality by choosing a different logic we can define a class of generalized event structures we introduce a new causal logic and associate a corresponding logical automaton to any finite safe petri net our main result is that the domain of configurations of this generalized event structure is isomorphic to the muller unfolding of the net

human beings are active agents who can think to understand how thought serves action requires understanding

how people conceive of the relation between cause and effect between action and outcome in cognitive terms how do people construct and reason with the causal models we use to represent our world a revolution is occurring in how statisticians philosophers and computer scientists answer this question those fields have ushered in new insights about causal models by thinking about how to represent causal structure mathematically in a framework that uses graphs and probability theory to develop what are called causal bayesian networks the framework starts with the idea that the purpose of causal structure is to understand and predict the effects of intervention how does intervening on one thing affect other things this is not a question merely about probability or logic but about action the framework offers a new understanding of mind thought is about the effects of intervention and cognition is thus intimately tied to actions that take place either in the actual physical world or in imagination in counterfactual worlds the book offers a conceptual introduction to the key mathematical ideas presenting them in a non technical way focusing on the intuitions rather than the theorems it tries to show why the ideas are important to understanding how people explain things and why thinking not only about the world as it is but the world as it could be is so central to human action the book reviews the role of causality causal models and intervention in the basic human cognitive functions decision making reasoning judgment categorization inductive inference language and learning in short the book offers a discussion about how people think talk learn and explain things in causal terms in terms of action and manipulation

abstract this paper is concerned with the problem of making causal inferences from observational data when the underlying causal structure may involve feedback loops in particular making causal inferences under the assumption that the causal system which generated the data is linear and that there are no unmeasured common causes latent variables linear causal structures of this type can be represented by non recursive linear structural equation models i present a correct polynomial time on sparse graphs discovery algorithm for linear cyclic models that contain no latent variables this algorithm outputs a representation of a class of non recursive linear structural equation models given observational data as input under the assumption that all conditional independencies found in the observational data are true for structural reasons rather than because of particular parameter values the algorithm discovers causal features of the structure which generated the data a simple modification of the algorithm can be used as a decision procedure whose runtime is polynomial in the number of vertices for determining when two directed graphs cyclic or acyclic entail the same set of conditional independence relations after proving that the algorithm is correct i then show that it is also complete in the sense that if two linear structural equation models are used as conditional independence oracles for the discovery algorithm then the algorithm will give the same output only if every conditional independence entailed by one model is entailed by the other and vice versa another way of saying this is that the algorithm can be used as a decision procedure for determining markov equivalence of directed cyclic graphs if the conditional independencies associated with two cyclic graphs result in the same output from the algorithm when used as input then the two graphs are equivalent

a major challenge children face is uncovering the causal structure of the world around them previous research on children s causal inference has demonstrated their ability to learn about causal relationships in the physical environment using probabilistic evidence however children must also learn about causal relationships in the social environment including discovering the causes of other people s behavior and understanding the causal relationships between others goal directed actions and the outcomes of those actions in addition many of the causal relationships children experience do not occur in the physical world at all but instead occur in richly causal imaginary worlds in this dissertation we argue that social reasoning and causal reasoning are deeply linked both in the real world and in children s minds children use both types of information together and in fact reason about both physical and social causation in fundamentally similar ways we suggest that children jointly construct and update causal theories about their social and physical environment and that this process is best captured by probabilistic models of cognition we also argue that causal pretense may serve as a form of counterfactual causal reasoning allowing children to explore causal what if scenarios in alternative imaginary worlds and suggest a theoretical link between the development of an extended period of immaturity in human evolution and the emergence of powerful and wide ranging causal learning mechanisms we investigate the

complex and varied ways in which children learn causal relationships through three primary lines of research each of which extends probabilistic models beyond reasoning about purely physical causes while also characterizing the distinctive aspects of causal pretense and social causal reasoning in the first set of studies we examine how causal learning can influence the understanding and segmentation of action and how observed statistical structure in human action can affect causal inferences we present a bayesian analysis of how statistical and causal cues to segmentation should optimally be combined as well as four experiments investigating human action segmentation and causal inference we find that both adults and our model are sensitive to statistical regularities and causal structure in continuous action and are able to combine these sources of information in order to correctly infer both causal relationships and segmentation boundaries the second line of work examines how the social context influences children s causal learning focusing particularly on children s imitation of causal actions we define a bayesian model that predicts children will decide whether to imitate part or all of an action sequence based on both the pattern of statistical evidence and the demonstrator s pedagogical stance we conducted an experiment in which preschool children watched an experimenter repeatedly perform sequences of varying actions followed by an outcome children s imitation of sequences that produced the outcome increased in some cases resulting in production of shorter sequences of actions that the children had never seen performed in isolation a second experiment established that children interpret the same statistical evidence differently when it comes from a knowledgeable teacher versus a naive demonstrator suggesting that children attend to both statistical and pedagogical evidence in deciding which actions to imitate rather than obligately imitating successful action sequences the final line of work explores the relationship between children s understanding of real world causal structure and their pretend play we report a study demonstrating a link between pretend play and counterfactual causal reasoning preschool children given new information about a causal system made very similar inferences both when they considered counterfactuals about the system and when they engaged in pretend play about it counterfactual cognition and causally coherent pretense were also significantly correlated even when age general cognitive development and executive function were controlled for these findings link a distinctive human form of childhood play and an equally distinctive human form of causal inference we speculate that during human evolution computations that were initially reserved for particularly important ecological problems came to be used much more widely and extensively during the long period of protected immaturity

over the past twenty five years a large number of algorithms have been developed to learn the structure of causal graphical models many of these algorithms learn causal structures by analyzing the implications of observed conditional independence among variables that describe characteristics of the domain being analyzed they do so by applying inference rules data analysis operations such as the conditional independence tests each of which can eliminate large parts of the space of possible causal structures results show that the sequence of inference rules used by pc a widely applied algorithm for constraint based learning of causal models is effective but not optimal this is because algorithms such as pc ignore the probability of the outcomes of these inference rules we demonstrate how an alternative algorithm can reliably outperform pc by taking into account the probability of inference rule outcomes specifically we show that an informed search that bases the order of causal inference on a prior probability distribution over the space of causal constraints can generate a flexible sequence of analysis that efficiently identifies the same results as pc this class of algorithms is able to outperform pc even under uniform or erroneous priors

causation is at once familiar and mysterious we can detect its presence in the world but we cannot agree on the metaphysics of the causal relation l a paul and ned hall guide the reader through the most important philosophical treatments of causation and develop a broad and sophisticated understanding of the issues under debate

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