

Driverless: intelligent cars and the road ahead. Hod Lipson and Melba Kurman. 2016. Year. Cambridge MA: The MIT Press. \$12.95 (hardback). ISBN 978-0-262-03522-4

This book summarises developments in cars driven by artificial intelligence (AI). It is written for the mass market, and explains concepts through the history of the development of robotics.

Three summarising introductory chapters consider the autonomous car, its benefits and recent robotics developments. The book becomes more interesting in the following three chapters with greater detail on the background to developments in robotic operating systems since the first world war, the unfolding story of the development of machine learning AI, and attempts in the 1950s to create autonomous vehicles. A seventh chapter argues against smart highways. This rejection of smart highways comes before the three chapters that describe developments towards current driverless technology: the U.S. Defense Advanced Research Projects Agency (DARPA) challenges of 2004, 2005 and 2007; the current 'anatomy' of a driverless car; and the current state of the art of machine learning. The final two chapters describe the scale of the data challenge to feed AI, and some of the consequences of cars driven by AI.

The authors are roboticists, and the reader is very aware of this view of the world throughout the book. A strength of the book is the accessible way it explains the development of AI, and in particular the difference between symbolic, or rule based, AI, and data driven or machine learning AI. A strikingly interesting development to me was the way that machine learning has developed from having clever algorithms, but with poor data for training, to having simpler algorithms, but with massive amounts of data that can now be thrown at them to train them.

Arguably, the fact the authors emerge from just one field of inquiry is a limitation of the book. While on the one hand their ability to conjure up different types of consequence of cars driven by AI were on the whole convincing, on the other hand I was not left feeling that all branches of the 'road ahead' has been fully explored. A wider purview would have included insights from sociology and philosophy. At a more straightforward level it would have been good to see a wider understanding of the issues from a transport and mobilities point of view.

The three general introductory chapters explored a number of scenarios such as 'what if the effect is to take people off the streets because of the door to door nature of the delivery'. The depth of inquiry did not go much beyond the simple making of the observation: 'side effects' were sometimes only touched on. The final chapter, did, however, deal with some of the earnest issues concerning economic effects (on jobs and health spending), insurance industry issues, and legal and practical issues around car ownership and use.

There are many technical issues about the ability, should we wish to do so, of communication between vehicles (V2V) and to the infrastructure (V2I). These connectivity issues include latency in communication and cyber security. Rather than exploring these technical challenges, the seventh chapter, dismissed the need for intelligent infrastructure. This dismissal was based on an as yet not fully explicated case for why vehicles driven by AI will not need this connectedness. Somewhat contradictorily, however, there did seem to be a view that messages to the vehicle to help it navigate away from congestion could be beneficial, but at the same time the message appeared to be that control by municipal authorities would be seen as interference. The context of the direction of travel of the seventh chapter only begins to be realised after the full detection capability, particularly based on visual recognition, of emerging cars driven by AI is subsequently explained.

The underlying unchallenged assumption is that the direction of travel is towards the use of more artificially intelligent robots in general, and in transport in particular. However, perhaps the most telling sentence comes in the final chapter: 'Only the passage of time will reveal whether we're currently on the cusp of another period of sweeping social change, or whether we'll eventually dismiss driverless cars as just another over-hyped emerging technology that failed to bear fruit'. The book lives up to the promise of discussing the 'intelligent car', but, based on the single point of view of roboticists, appears less well qualified to illuminate 'the road ahead', as the last part of the title implies. This illumination would require a wider range of academic input.

The book will work for a popular audience, and it has been structured in that way. At the level of the book, the chapter order is designed to whet the appetite, and then draw the reader into to greater detail. At the level of the chapter, the conclusions are often drawn early on, with the supporting evidence coming later in the chapter, especially for example in the chapter on smart infrastructure. This is fine at one level, but is slightly irritating for an audience that may prefer arguments to be laid out with the facts first, the critical reasoning second and the conclusions last. But this irritation is a small price to pay for being educated very clearly on the way roboticists think about autonomy in the field of transport.

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