related to fluid circulation in the oceans and atmosphere. In the context of global change and warming climate, these questions have acquired further importance. Ma *et al.* look at how a warming climate changes the atmospheric circulation in the tropics and how it is going impact rainfall in those regions. That such research is vital for the countries like India, where vagaries of the monsoon do not need a reality check anymore. Coogan and Gillis outline the present understanding of the low-temperature advection of sea water through upper oceanic crust ('off-axis' hydrothermal circulation), and the feedback systems that modulate ocean chemistry and its impact on climate. Ferreira *et al.* examine how the Atlantic deep-water formation is impacted by different climate states. It is now known that some planets like Venus, or Titan, the moon of Saturn exhibit phenomena like super-rotation with respect to the circulation of winds and fluids that move 60 times more than the planet itself. This has become a huge challenge to the modellers, and serves as the topic of discussion in an article by Read and Lebononois.
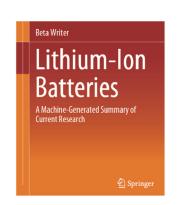
Environmental factors are major drivers in evolutionary patterns and processes. As in previous volumes, this collection also showcases such articles. The proboscideans (mammoths), ancestors of modern elephants had to deal with the warming high latitudes. Fisherfinds evidence for their diet and the then existing environmental conditions from the analyses of preserved soft tissues and tusks of their specimens. One of the articles in this category discusses the evolution and divergence of seals, walruses and sea lions based on fossil evidence. First seen in the Oligocene, major pinniped divergence occurred in the Neogene. How did the improvement in sensory capabilities provide evolutionary advantages to the Palaeozoic amniote vertebrates? Müller *et al.* examine this question.

This volume has little representation from planetary sciences. Except for an article regarding super-rotation on Venus and Titan, there are hardly any papers on planetary sciences compared to three articles on evolutionary or palaeobiology, which should have been more appropriate for the *Annual Review of Ecology, Evolution, and Systematics*. As a reader, I would expect more representative reviews on the processes that make our planet 'endlessly dynamic', along with the exciting developments in the planetary sciences. The present volume, however, does not disappoint us as it showcases scholarly reviews on some of the intriguing questions in Earth and planetary sciences.

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Lithium-Ion Batteries: A Machine-Generated Summary of Current Research. Beta Writer. Springer Nature Switzerland AG, Gewerbestrasse 11, 6330 Cham, Switzerland. 2019. xxxv + 247 pages. Price: 51,99€. ISBN 978-3-030-16800-1 (eBook).

The title of this book, at the outset generates curiosity and excitement in the minds of all type of readers – generally interested in science and engineering – although most may not have any knowledge regarding machine intelligence or battery technology. The so-called virtual author Beta Writer holds the mysterious key, as what is depicted here is a joint attempt between Springer Nature and researchers from Goethe University Frankfurt, Germany. The primary objective is to develop an algorithm for a machine-generated book on lithium (Li)-ion batteries due to its contemporary importance (e.g. electric vehicles), and also due to a highly crowded multidisciplinary research. Li-ion batteries have captured the interest of the whole world due to impressive developments in the last few decades not only in innovative materials in terms of performance parameters like capacity, long cycle life, fast charge–discharge rate and environment-friendly operation, but for automated battery maintenance software technology also for sustaining human mobility. However, my first impression is disappointment and a negative perception, and I hope my little knowledge in batteries and more specifically on the status of Li-ion battery research might not be the culprit. In any case, the general expectations arising from such a seductive title are not met despite the explicit statement in the introduction that this book could serve the reader as a platform for defining the current status of the technology. Further, the claim about providing an overview on the latest trends of Li-ion battery research is not justified, except perhaps providing a veritable cornucopia of materials under various chapter titles in a protracted manner with plenty of avoidable repetitions and ambiguous linkages. Ironically, the second part of the book title actually bails out the criticism to some extent as one cannot intuitively expect a cogent and interconnected description unless human brain intervenes. The application of similarity-based clustering routine is mainly responsible for the lack of coherence in chapters and sections and to some extent, the needlessly stretched text in every chapter and the lack of succinct summaries in the conclusion sections. In contrast, meaningful and enjoyable texts have been completely generated by machine intelligence in many cases of film scripts, music, fiction, market reports, sports, weather forecasting, etc. and judging by the level of complexity, one could, of course, be optimistic to rectify all limitations in subsequent refined versions.

The book has a long preface (by Henning Schoenenberger) providing the background behind the automatic generation of 'meaningful' research text using machine learning. The system architecture and implementation details are provided with the help of a flow chart in order to indicate the transparency in text generation and extractive summarization. The narration has, however, an apologetic undertone, not in a strident way, but in a subtle manner in describing all details of machine processing. For example, when 53,000 articles are scanned (but not understood) with respect to certain keywords related to applications, the nature of input decides the outcome and a minor variation can have disastrous

consequences. The selection of topics like 'why Li-batteries' is justified tacitly as it is a key technology enabling future and, more importantly, there has been an explosion of interest by researchers in diverse disciplines like electrical engineers, mechanical engineers, chemists, physicist, materials scientists, and even medical professionals searching for a new generation of Li-ion batteries for various application domains. Lighter, smaller, more long-living yet safer are the mantras, and one gets lost in the ocean of literature if followed blindly. This is what exactly the book has done and one can always hope to have several versions of continuous improvement with human intervention to eventually get a book of acceptable interest, especially because the preface identifies all possible limitations categorically and promises to overcome them. Paradoxically, the publisher also states that in order to facilitate a broad discussion on the future opportunities, challenges and limitations, they deliberately refrained from any manually polishing or copy-editing to highlight the current status and remaining boundaries of machine-generated content, but I find this hard to digest.

At the face, everything looks fine with contents and the connection is strong as a battery consists of anode, cathode and electrolyte and all are dealt with sequentially, but there are many problems as we closely approach each chapter. First, in many places, the scientific precision is sacrificed while dealing with themes, perhaps due to too much of emphasis on keywords. For example, consider the case of the first chapter itself, viz. 'Anode materials, SEI, carbon, graphite, conductivity, graphene, reversible, formation'. Any electrochemist will struggle to make an intelligent description of all these terms as this looks like an 'outline' story with huge gaps, although one can fill in all the blanks with suitable connections and descriptors based on the background knowledge. Except the first two words, all are common for cathodes and anodes, and grouping nouns and adjectives itself must show some syntax error, which is surprising in the title. More important are the problems from sentence compression and restructuring carried out mechanically so that the subsections in each chapter have no relevance or connection. If the aim is to showcase a wide range of materials with varied structures and functions, this

chapter is useful especially if one distils the contents and discards the residue consisting of the repeated parts about general importance and performance limitations.

The next chapter, viz. 'Cathode materials, samples, pristine, layered, doping, discharge capacity' also offers bland text and there are specific difficulties. All other terms in the title except the first and last are not relevant and there are many instances in the text where conceptual discontinuities abound. Pronouns like 'we' and 'they' come in the text to annoy the reader and too many materials are placed verbatim to increase the difficulty of comprehension. The machine or software as a narrator does not understand the sensibility of the reader's mind, not even a fraction, and hence there is a big problem in holding the attention span not only in this chapter but in all subsequent chapters as well. The next chapter entitled 'Ionic conductivity, polymer electrolyte, membranes, electrochemical stability, separators' also has these limitations and the conclusion does not provide any significant statement or key information, either generic or inclusive of the chapter contents.

The last chapter entitled 'Models, SOC, maximum, time, cell, data, parameters' also has several ambiguities not only in the title, but in almost all paragraphs. For example, the first few sentences itself leave the reader with many unanswerable questions like 'our earlier work – whose?', 'what restricted instrument is used to examine the obscure thermochemistry in lithium ion batteries'? and similar difficulties in a much more exacerbated way. Thermal runaway is actually an important failure mode of real batteries causing leakage, swelling, fire or rupture due to abuse, but jumbled sentences and paragraphs with no beginning or end having unnecessary repetition of what is described earlier create exasperation. Sentences like 'he positive electrode is named as the negative electrode as the anode and the cathode in the remainder of this manuscript and throughout the scientific literature' have no meaning and will only isolate the readers, although a reference is cited which actually exacerbates the confusion. Interestingly, in some rare cases, the differences between 'aqueous solutions of cell culture medium and cell pellet solutions' are confused with electrochemical cells and one wonders why

the software is unable to separate between the blood and cerebrospinal fluid (CSF) barrier in a porcine cell culture model to mathematical models of cell and battery failure. However, this chapter provides much useful information related to fire safety and thermal/mechanical/electrical abuse and validation protocols of Li-ion batteries, blended heterogeneously with about 70% of irrelevant or excessively duplicated text. Although one full chapter is devoted to the cathode materials, again the same material is discussed with insignificant changes is not clear. Indeed such avoidable duplication is a major deterrent to the flow of reading.

A book like this compiled by machine language prima facie has many advantages. The novelty is eye-catching, especially since this is the first attempt to make a collection relevant to battery researchers from diverse areas like chemistry, physics, materials science, electrical engineering and mechanical engineering using machine intelligence. In addition to this interdisciplinary approach, the means of overcoming all technological and publishing challenges are per se exciting. The relationship between the software writer and the multiple authors of articles raises interesting questions to ponder and perhaps resolve in subsequent versions. There are also advantages like automatic updating as and when new literature adds up and self-identification of corrections and refinements. Indeed, many types of activities impossible for human beings like going through 300 articles in 10 min and adding all the so-called important points in few minutes, checking typo in the entire book in a few seconds, search possibility of everything in the text as and when it is needed, etc. could be done efficiently by the powerful algorithm.

Despite the confidence that artificial intelligence is capable of automatically including all important themes and materials in the entire pre-defined collection, many possibilities of improvement exist in the next version as listed in the end of the preface. More significantly, machine intelligence has no ethical or moral concerns, and it is free to copy any part from any given text with matching descriptors within the confined boundaries created by keywords. Technology here cannot be considered to be helping human efficiency from the aesthetic or creative point of view as these books will have difficulty

in finding interested readers among even researchers in the exact disciplines itself. When the summary length is pre-decided to be x% of the original text (mostly defining the number of words) uniformly across all articles, damage happens since the algorithm cannot discriminate important from unimportant, especially with respect to what has been summarized earlier beyond the similarity in keywords and semantics. The weighted combined ranking and sentence restructuring are only passive exercises and both the quality of the text and the deeper insight are obviously lost, and this is clearly seen in all chapters. Each chapter has its own conclusion (mostly not useful), but a general conclusion integrating all material issues and performance characteristics would have been good considering the voluminous information in chapters with diverse types of material and existing gaps in these chapters.

In conclusion, the automated summary of a large number of contemporary articles and reviews does not seem to have helped much to increase the quality in selection. A large improvement throughout the entire book is needed in the next version to take care of the worrying signals like incoherence in chapters and lack of continuity of subthemes within chapters. The plan to have similar machine-generated books in other subject areas like humanities and social sciences, might pose more challenges in terms of finding the right section of readers, although the interdisciplinary approach might create many profound discussions on the general impact of machine intelligence on the publishing industry.

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