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Chapter 1 : An evaluation of the accuracy-efficiency tradeoffs of neural language models

The Perplexity of Complexity Ian Whittingham PMI United Kingdom Chapter - December 15, Ian Whittingham, PMP is a Program Manager in the Business Transformation group of a leading global news and information company.

Please note that this post is for my future self to look back and review the materials on this paper without reading it all over again. Paper from this website Abstract T-sne is most widely used for dimensionality reduction method to view higher dimensional data, however it has a hyper-parameter called perplexity. In this paper the authors propose a method that can automatically tune this parameter with negligible extra computational cost. Introduction According to Maaten and Hinton t-SNE results are robust to the settings of perplexity, however, in application users have to compare results from different perplexity values to choose the optimal value. The lack of automation on selecting this hyper-parameter might lead to misrepresenting the data. Then using the KL divergence it tries to match the distributions. Automatic selection of perplexity As perplexity increase the loss from KL divergence decreases, seen above, by this fact we know that using only the KL divergence as loss function we will most likely end up with high perplexity values. However, those high perplexity values are not always optimal. When we set the perplexity to the maximum value, which is number of data points, it fails to capture any interesting structure within the data. Considering the trade off between perplexity and KL divergence the authors have introduced a criteria below. Interpretation as reverse complexity tuning via pseudo BIC pBIC In Bayesian Information Criteria, as seen above, the first term measures the goodness-of-fit of the maximum-likelihood-estimated model, and the second term controls the complexity of the model by penalizing the number of free parameters k. And we can see that the equation above resembles the authors equation both in forms as well as balancing the data-fit and complexity. The difference between those two equation is instead of increasing the complexity of the model to fit the data better increasing the perplexity value, reduces complexity of the pattern in data to be modeled. Since we are considering more and more data points as neighbors, also the authors discuss one fun fact. The KL divergence loss function has a large cost when for underestimating the probability but not for overestimating. Additionally, the authors makes connection to Minimizing Some Description Length as well. Validation With Inferred Human Experts Preferences On Perplexity To test the validity of the authors method, the authors compared the chosen perplexity values resulted from the criteria equation vs the perplexity values that an expert have chosen. On a wide varieties of data set. And as see above, we notice that there is not that much difference between the value chosen by the authors equation when compared to the value chosen by the experts. Conclusion In this paper the authors have introduced a new method that can automatically select the optimal value for perplexity when using t-sne. Retrieved 11 September , from https:

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Chapter 2 : perplexity | Definition of perplexity in English by Oxford Dictionaries

From Complexity to Perplexity Can science achieve a unified theory of complex systems? Even at the Santa Fe Institute, some researchers have their doubts.

I used a basic example to get my head around this, and I found that 7 entries evenly fills a tree with 3 layers. But log2 7 is 2. So what am I missing here? Even if there is no error in the math, we can see that 2. Once you get into the s of entries, log2 is much much better than linear. I think you see this though, so onto next. When I think about a perfect tree of 8 entries, I see a 3 level deep tree with 8 total leaves. In this tree, no matter which number you search, it takes 3 total compares to get from root to leaf. Not the number of nodes? Well that was a big piece of information that I was missing.. Seems strange to me that the function is based on leaves, when each branching node is also a potential stop point. Well anyway, thanks for straightening that out for me! This is called big O notation. The way you should interpret this is that the asymptotic growth of the time the function takes to execute given an input set of size n will not exceed log n. This is just formal mathematical lingo in order to be able to prove statements, etc. It has a very straightforward explanation. When n grows very large, the log n function will out-grow the time it takes to execute the function. The size of the "input set", n, is just the length of the list. Simply put, the reason binary search is in O log n is that it halves the input set in each iteration. On x iterations, how long list can the binary search algorithm at max examine? From this we can see that the reverse is that on average the binary search algorithm needs log2 n iterations for a list of length n.

Chapter 3 : Complexity and Consciousness | The Chrysalis

And without considering the multiplicity and complexity of the conditions any one of which taken separately may seem to be the cause, he snatches at the first approximation to a cause that seems to him intelligible and says: "This is the cause.

Can science achieve a unified theory of complex systems? The museum is hosting a dinner for the Santa Fe Institute, where complex people ponder complex things. Langton, clad in his uniform of jeans, clodhoppers, leather vest and silver bracelet; the ruddy-faced nonlinear economist W. Brian Arthur, who has recently been taking calls from the White House; and world-class intellectual riffer Stuart A. Kauffman, whose demeanor is at once cherubic and darkly brooding. Mingling with these scientific pioneers are various "friends of the institute," ranging from mega-philanthropist George Soros to the best-selling novelist Cormac McCarthy. There certainly is, at least from a public-relations standpoint. The institute is not large: Nevertheless, in the decade since its founding, the institute has enjoyed much favorable attention from the press, including Scientific American, and has been celebrated in several popular books. It has become renowned as a leading center of complexity studies, a place where scientists impatient with the stodgy, reductionist science of the past are creating a "new, unified way of thinking about nature, human social behavior, life and the universe itself" as one book jacket put it. What Liddle does not say is that even some scientists associated with the institute are beginning to fret over the gap between such rhetoric and reality. Cowan, a mathematical biologist from the University of Chicago who helped to found the institute and remains on its board. Cowan is no scientific prude; he has explored the neurochemical processes underlying the baroque visual patterns evoked by LSD. But some Santa Fe theorists exhibit too high a "mouth-to-brain ratio" for his taste. Cowan finds some work at Santa Fe interesting and important, but he deplores the tendency of research there "to degenerate into computer hacking. Yet the economist cannot help but play the evangelist. Charles Darwin might have discovered a great deal about computers and very little about nature. Holland, a computer scientist with joint appointments at the University of Michigan and the Santa Fe Institute, spelled out this breathtakingly ambitious vision in a lecture two years ago: The systems that host these problems-economies, ecologies, immune systems, embryos, nervous systems, computer networks-appear to be as diverse as the problems. Despite appearances, however, the systems do share significant characteristics, so much so that we group them under a single classification at the Santa Fe Institute, calling them complex adaptive systems [CAS]. This is more than terminology. It signals our intuition that there are general principles that govern all CAS behavior, principles that point to ways of solving the attendant problems. Some workers now disavow the goal of a unified theory. It becomes just another place where researchers are using computers and other tools to address problems in their respective fields. Scientists familiar with the history of other would-be unified theories [see box on pages and] are not sanguine about the prospects for their brethren at Santa Fe. One doubter is Herbert A. Simon of Carnegie Mellon University, a Nobel laureate in economics who has also contributed to artificial intelligence and sociobiology. He accuses complexologists of seeking a "magic criterion" that will help them unravel all the messy intricacies of nature. The problems of complexity begin with the term itself. Complexologists have struggled to distinguish their field from a closely related pop-science movement, chaos. When all the fuss was over, chaos turned out to refer to a restricted set of phenomena that evolve in predictably unpredictable ways. Various attempts have been made to provide an equally precise definition of complexity. The most widely touted definition involves "the edge of chaos. On the other hand, completely chaotic systems, such as turbulent fluids or heated gases, are too formless. Truly complex things-amoebae, bond traders and the like-appear at the border between rigid order and randomness. Most popular accounts credit the idea to Christopher Langton and his co-worker Norman H. Packard who coined the phrase. Crutchfield and Mitchell, did not support the conclusions of Packard and Langton. Crutchfield and Mitchell also question whether "anything like a drive toward universal-computational capabilities is an important force in the evolution of biological organisms. Other definitions of complexity have been proposed-at least 31, according to a list compiled several years ago by Seth Lloyd of the Massachusetts Institute of Technology, a physicist and Santa Fe adjunct. Most involve concepts such as entropy, randomness and information-which themselves have proved to be notoriously slippery terms. All definitions have drawbacks. Chaitin, holds that the complexity of a system can be represented by the shortest computer program describing it. But according to this criterion, a text created by a team of typing monkeys is more complex-because it is more random-than Finnegans Wake. The Poetry of Artificial Life Such problems highlight the awkward fact that complexity exists, in some murky sense, in the eye of the beholder. At various times, researchers have debated whether complexity has become so meaningless that it should be abandoned, but they invariably conclude that the term has too much public-relations value. Complexologists often employ "interesting" as a synonym for "complex. Complexologists may disagree on what they are studying, but most concur on how they should study it: This faith in computers is epitomized by artificial life, a subfield of complexity that has attracted much attention in its own right. Artificial life is the philosophical heir of artificial intelligence, which preceded it by several decades. Whereas artificial-intelligence researchers seek to understand the mind by mimicking it on a computer, proponents of artificial life hope to gain insights into a broad range of biological phenomena. And just as artificial intelligence has generated more portentous rhetoric than tangible results, so has artificial life. As Langton proclaimed in the inaugural issue of the journal Artificial Life last year, "Artificial life will teach us much about biology-much that we could not have learned by studying the natural products of biology alone-but artificial life will ultimately reach beyond biology, into a realm we do not yet have a name for, but which must include culture and our technology in an extended view of nature. There are simple sets of mathematical rules that when followed by a computer give rise to extremely complicated patterns. The world also contains many extremely complicated patterns. Simple rules underlie many extremely complicated phenomena in the world. With the help of powerful computers, scientists can root those rules out. This syllogism was refuted in a brilliant paper published in Science last year. The authors, led by philosopher Naomi Oreskes of Dartmouth College, warn that "verification and validation of numerical models of natural systems is impossible. Natural systems are open: How much is based on observation and measurement of accessible phenomena, how much is based on informed judgment, and how much is convenience? Mathematical theories are less compelling when applied to more complex phenomena, notably anything in the biological realm. As the evolutionary biologist Ernst Mayr of Harvard University has pointed out, each organism is unique; each also changes from moment to moment. That is why biology has resisted mathematicization. Langton, surprisingly, seems to accept the possibility that artificial life might not achieve the rigor of more old-fashioned research. Science, he suggests, may become less "linear" and more "poetic" in the future. Smith, who pioneered the use of mathematics in biology, took an early interest in work at the Santa Fe Institute and has twice spent a week visiting there. But he has concluded that artificial life is "basically a fact-free science. The owlish, pugnacious Bak bristles with opinions. He asserts, for example, that particle physics and condensed-matter physics have passed their peaks. Bak and others have developed what some consider to be the leading candidate for a unified theory of complexity: As one adds sand to the top of the pile, it "organizes" itself by means of avalanches into what Bak calls a critical state. If one plots the size and frequency of the avalanches, the results conform to a power law: Bak notes that many phenomena-including earthquakes, stock-market fluctuations, the extinction of species and even human brain waves-display this pattern. He concludes that "there must be a theory here. Work on complex systems, he adds, will bring about a "revolution" in such traditionally soft sciences as economics, psychology and evolutionary biology. He and other workers at Chicago found that their sandpile tended to oscillate between immobility and large-scale avalanches rather than displaying power-law behavior. Bak retorts that other sandpile experiments confirm his model. Nevertheless, the model may be so general and so statistical in nature that it cannot really illuminate even those systems it describes. After all, many phenomena can be described by a Gaussian or bell curve. But few scientists would claim that human intelligence scores and the apparent luminosity of galaxies must derive from common causes. Another skeptic is Philip W. In "More Is Different," an essay published in Science in , Anderson contended that particle physics and indeed all reductionist approaches have only a limited ability to explain the world. Reality has a hierarchical structure, Anderson argued, with each level independent, to some degree, of the levels above and below. Anderson acknowledges as much. Kauffman has spent decades trying to show-through elaborate computer simulations-that Darwinian theory alone cannot account for the origin or subsequent evolution of life. Kauffman says he shares the concern of his former teacher John Maynard Smith about the scientific content of some artificial-life research. The molecules begin spontaneously combining to create larger molecules of increasing complexity and catalytic capability. Kauffman has argued that this process of "autocatalysis"-rather than the fortuitous formation of a molecule with the ability to replicate and evolve-led to life. This ordering principle, which Kauffman calls "antichaos," may have played a larger role than did natural selection in guiding the evolution of life. More generally, Kauffman thinks his simulations may lead to the discovery of a "new fundamental force" that counteracts the universal drift toward disorder required by the second law of thermodynamics. In a book to be published later this year, At Home in the Universe, Kauffman asserts that both the origin of life on the earth and its subsequent evolution were not "vastly improbable" but in some fundamental sense inevitable; life, perhaps similar to ours, almost certainly exists elsewhere in the universe. Of course, scientists have engaged in interminable debates over this question. Others, like the great French biologist Jacques Monod, have insisted that life is indeed "vastly improbable. In his book, The Quark and the Jaguar, Gell-Mann sketches a rather conventional-and reductionist-view of nature. The probabilistic nature of quantum mechanics allows the universe to unfold in an infinite number of ways, some of which generate conditions conducive to the appearance of complex phenomena. As for the second law of thermodynamics, it permits the temporary growth of order in relatively isolated, energy-driven systems, such as the earth. The Santa Fe Institute seemed to raise that possibility last year when it hosted a symposium on "the limits of scientific knowledge. Francisco Antonio Doria, a Brazilian mathematician, smiled ruefully and murmured, "We go from complexity to perplexity.

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Chapter 4 : calendrierdelascience.com - How can I track requirements across projects?

shows that the careers of the cohort (topmost sequence) are consistently more ordered than for the cohort (second, shorter sequence).

In lieu of an abstract, here is a brief excerpt of the content: His own The Bostonians and The Princess Casamassima were critical failures, and he had begun to see the depiction of history in the novel as an unsolvable problem of form. For now he had abandoned the novel. But in America Howells enjoyed commercial success as well as a steady and prodigious output. Hazard had captured a truth about American life in all its complexity and interest, but it had done so at the expense of form. It was careless and inartistic, even incoherent. Yet James sensed that pressing the issue of composition was not quite right. Was there a conscious plan? He was reconsidering his basic assumptions about form. Howells seemed to have designed his novel according to the vagaries, incoherencies, and multiplications of ordinary reality. He captured in the apparently insignificant details of middle-class life the flux of experience in America, where history was still in the making. Still, James sensed that in Hazard the material and the expression were aligned in some interesting ways, the results more important than the lapses in composition. What Howells knew, and what James came to realize by reading Howells, was that novel-writing was a mode of historical thinking: The novelist, through the design of character and plot, indeed in the development of sentences, pursued the historical evidence and discovered the real everyday life. It was not theoretical truth he sought, or the transcendent morality of the conventional novel. Howells wrote in order to find out the truth about ordinary life, and the more he discovered the more his novels tended toward disjunction. Of course in political terms, a middle-class culture considers everyone ordinary. It is assumed that everyone shares the same economic goals and the You are not currently authenticated. View freely available titles:

Chapter 5 : Perplexity | Define Perplexity at calendrierdelascience.com

Perplexity is confusion that results from something being complicated. The instruction manuals for computer components might put a look of perplexity on your face. If you think of the word complexity â€" which is when something is really intricate or involves lots of complicated parts â€" it might help you remember that perplexity is the state.

Alan Schlottmann, in dreaming up the idea for this assessment project, came up with Finally, in a provocative piece, Partridge and Rickman ask: The Review of Regional Studies, Vol. I argue that we have entered a product-specialization stage in regional science scholarship and that there may now be a need for some broad synthesizing research such as that characteristic of earlier years of the research venture. In that spirit, I present some information about the forthcoming new system of Core-Based Statistical Areas. I use an experimental version of the new system of Metropolitan and Micropolitan Statistical Areas to illustrate some urban-scale effects evident in recent county-level growth trends. Regional Growth and Change: I gratefully acknowledge the contributions of my doctoral student Christopher Henrie for his GIS and data-analysis assistance and the support of the U. Nor are we especially skilled at setting broad agendas for future research. Usually when we are offered the opportunity to make such assessments, we pull a couple or three dripping wet studies out of the babbling brook of current research. These we proudly hold up as if for the event-recording camera as prototypes for the way things ought to be done henceforth. Or else we use the occasion as a happy excuse to tout our own current research fancies. Regional Growth and Change. Schlottomann and Bartik in their introduction make the pitch for at least a bifurcation of the research. They distinguish two broad strands of thought: It strikes me that with as broad a topic as the regional science of growth and change we will always exhibit a tendency to scurry back into our own warm and familiar bailiwicks. Projects such as this one can be quite useful because they encourage us to pop our heads up from those prairie dog holes long enough to scout around and see what others, nearby, are doing. Are we now in need of some synthesizing scholarship â€" the Bill Alonso, the Brian Berry, the Walter Isard style of work â€" that seeks to extract the big picture from among the tangles of the specialized literatures? In thinking about the role of the growth and change literature in regional science, my mind churned up a presidential address by John Fraser Hart to the Association of American Geographers back in Hart In seeking to understand the multiplicity of causes for regional growth and decline in developed countries possessing highly interdependent urban systems, we engage ourselves in a quest fraught with extreme complexity if not perplexity. A full understanding may always lie beyond our grasp; a good partial one may depend on harmonizing a multiplicity of perspectives. Riddel and Schwer tackle a basic issue: What changes economic history? What is it that sets in motion the swirling patterns that we try to track when we pour over variables measuring growth and change? What are the underlying incubating conditions that lead to innovation? Kim, Pickton, and Gerking tackle issues connected to another stimulus for growth and development: They make the point that FDI is inherently footloose: Their data and analysis highlights, though, the role of existing and developing industrial specialization and inter-industry complexes. And they tackle rather head-on one of the big themes that runs throughout most of the growth literature: They ask the question: Brown, Hayes, and Taylor also focus on policy instruments, seeking to expand our understanding of how state and local policies influence factor markets. Through their modeling they contest that policies more profoundly influence the private capital-to-labor ratio in a region than private output. West treats modeling issues. Two very interesting aspects of her article are: Too rarely have differing disciplinary practices for related growth and change problems been compared. And also too rarely have we focused on the functional geographic scale â€" the metropolitan region â€" at which so many of the locational decisions are made that determine aggregate growth and change at broader regional scales such as the state level. To what extent is this true for the country as a whole? Quigley emphasizes the importance of economic diversity or heterogeneity for sustained city growth. His work focuses on the role of economies arising from: The maps in Figures 1 and 2 illustrate county-level growth patterns in the U. For one thing, it was then that modern regional science was coming into existence: This time span also may be the approximate median life span of readers of this journal? While longer-term historical perspectives may indeed be revealing we should probably set our work in the context of the sweep of history since the beginnings of the industrial revolution! I also pick the s as our jumping off point because a watershed in U. In this paper he extolled the seeming inexorability of agglomerative advantages of the national core territory, which he identified as the American Manufacturing Belt plus Megalopolis. The trends extant during the s can now be seen as precursors to the stronger deconcentration patterns soon to come about â€” note the evidence of strong westward movement and the rise of areas on the Gulf Coast and Florida in Figure 1. However, in the final years of the post-war decade, Ullman could still confidently proclaim the ongoing primacy of the core. With respect to the majority of the land area of the country outside the approximately state core, he observed: In contrast to the core areas the prospects for the fringe or corner areas appear rather bleak, since they are remote from the center of the system and the self generating momentum of the center. Their best hope is to possess some special lure such as the present role of climate of California or Florida, or, in the past, the superior trees in the Pacific Northwest. Only by such lures have the corner areas been able to overcome their remoteness from the Industrial Beltâ€¦ Ullman , p. The decadal growth rate for the s was A half of a century later, growth and development trends are rather different. But we know a good deal. We know that capital is hugely more mobile and less placerooted. We appreciate that labor factors have risen to the fore, and these are more variegated than was previously the case. And we believe in a major role for natural amenities. In fact, many of our regional science brethren derive considerable utility from hedonically pursuing their measurement and valuation. So what perspectives are suggested for the research ahead? What I see is the need to bring both geography and demography more centrally into our analyses. More than ever I think his trumpet call is relevant to our future research agenda. No longer is it simply the age of mass production and mass consumption. Many growth industries are those that develop specialized products, seek out segmented markets, and engage in sophisticated analyses of marketing demographics. Similarly, for future regional growth research, productive synergies should be developed between demography and regional economics. We need to be more sensitive to questions about geographic scale. We need to spend more time scrutinizing geographic patterns. And we need to attempt to relate our general research findings to the functional geographic structures in which the processes we study are played out. Several of the papers in this package focus on the state level of analysis: But the functional economic units of growth and change are extended metropolitan regions. The debate was overly simplistic in drawing such a sharp dichotomy. Like the current MSAs, Metropolitan Statistical Areas defined according to the new standards will be composed of groups of counties centered on Urbanized Areas of 50, or more population. Urban Clusters are units analogous to Urbanized Areas in that they both delineate contiguous territory having high density of population. The Metropolitan and Micropolitan Statistical Areas shown in Figure 3 are defined on rather than Census commuting data and on Urbanized Areas. Incorporated place boundaries rather than Urban Cluster boundaries were used to define principal cities for the Micropolitan Statistical Areas. Changes in commuting patterns have taken place since that should result in some changes in the aggregation of outlying with central counties, and there will, of course, be differences between Urban Areas and their proxies. Two columns of percentages are shown. The overall rate is an aggregate figure for all population living in counties classified at a particular hierarchical level; the mean rate is the average rate for all counties falling into a particular CBSA classification. Central counties, however, account for overall majorities of total population. There is a clear size progression in terms of either set of growth rates. With two exceptions, the larger the CBSA unit, the faster the â€” rate of growth. These constitute an official class under the new OMB definitions: A relatively large share of national growth during the s took place in the very largest metro areas despite the fact that they were growing less rapidly than the nation as a whole. The absolute increase of inhabitants attendant to an Metropolitan areas of thousand to half a million grew slightly faster overall than did those with between half and one million population. In most instances commuting zones are contained within the same county as the Urban Clusters defined for micropolitan principal cities. For all levels of the metropolitan spectrum the outermost counties grew faster than areas at the cores. No big surprise or change over previous decades trends there. The new definitions pay some attention to such functional nesting. Provisions allow for Metropolitan and Micropolitan Statistical Areas to form a separate tier of combined areas in cases where there are moderately strong commuting ties, but the ties are not strong enough to qualify the areas to merge into a single unit. Under several earlier sets of standards for metropolitan area definition only the largest metroplexes were recognized as interconnected entities called Consolidated Metropolitan Statistical Areas CMSAs. Much attention in the growth literature has been given to spread and backwash effects Gaile Focusing on combinations up the size hierarchy recognizes that smaller Core-Based Statistical Areas positioned within major metropolitan conurbations may benefit from greater agglomeration economies spread effects than similarly sized areas situated outside the commuting ranges of large metropolitan areas.

Chapter 6 : [Paper Summary / borealisai] Automatic Selection of t-SNE Perplexity

perplexity - trouble or confusion resulting from complexity confusedness, disarray, mental confusion, muddiness, confusion - a mental state characterized by a lack of clear and orderly thought and behavior; "a confusion of impressions".

Chapter 7 : Project MUSE - W. D. Howells and the Perplexity of Henry James

One brave author follows this tortured soul in a work of astounding complexity and perplexity. My Name Is Dee It acts through subtraction, creating a space of perplexity that may be archived, reformatted, and structured to create new content.

Chapter 8 : Perplexity - Wikipedia

Perplexity of a probability distribution. The perplexity of a discrete probability distribution p is defined as = âˆ' âˆ' â•¡ ()where H(p) is the entropy (in bits) of the distribution and x ranges over events.

Chapter 9 : perplexity - Dictionary Definition : calendrierdelascience.com

Examples from the Web for perplexity Contemporary Examples of perplexity It is the perplexity of this situation that has caused most of the paralysis in Congress.