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Topological data analysis machine learning

I'm interested in the AI trends that shape how people and technology intersect and interact. Data distortions in machine learning are a type of error that heavily weights and/or displays certain elements of a dataset than others. A distorted dataset does not accurately represent the use case of a model, resulting in distorted results, low accuracy values, and analysis errors. In general, training data for machine learning projects must be representative of the real world. This is important because this data is the way the machine learns to do its job. Data distortions can occur in a number of areas, from human reporting and selection bias to algorithmic and interpretation biases. The following image is a good example of the types of distortions that can occur only in the data collection and annotation phases alone. Solving data distortions in machine learning projects means first of all determining where they are. Only when you know where there is bias can you take the necessary steps to remedy the situation, whether it's fixing missing data or improving your annotation processes. Against this background, it is extremely important to be vigilant about the scope, quality and handling of your data in order to avoid bias wherever possible. This not only affects the accuracy of your model, but can also cover issues of ethics, fairness, and inclusion. Below, I've listed seven of the most common types of machine learning data distortions to help you analyze and understand where it's happening and what you can do about it. (For more information on data collection and labeling for machine learning projects, here's a link to learn more about machine learning training data before reading the rest of the article.) Types of data biasAlthough this list is not exhaustive, it contains general examples of data distortion in the field and examples of where it occurs. Example distortion: Sample distortion occurs when a dataset does not reflect the realities of the environment in which a model is running. An example of this is certain facial recognition systems, which are mainly trained on images of white men. These models are much less accurate for women and people of different ethnic backgrounds. Another name for this bias is selection bias. Exclusion bias: Exclusion biases are most common in the data preprocessing phase. is about deleting valuable data that is considered unimportant. However, it may also be due to the systematic exclusion of certain information. For example, imagine you have a dataset on customer sales in America and Canada. 98% of customers come from America, so choose to delete the location data because you think this is irrelevant. However, this means that your model won't take up the fact that Canadian customers are spending twice more. Measurement Distortion: This type of distortion occurs when the data collected for training differs from that collected in the real world, or when incorrect data is data data distortion. A good example of this distortion can be found in image recognition datasets where the training data is collected with one camera type, but the production data is collected with another camera. Measurement distortions can also occur due to inconsistent annotations during the data labeling phase of a project. Callback Bias: This is a type of measurement bias and is common in the data labeling phase of a project. Callback distortions occur when you label similar data types inconsistently. This results in lower accuracy. For example, suppose you have a team that labeled pictures of phones as damaged, partially damaged, or undamaged. If someone labeled an image as damaged but a similar image as partially damaged, your data is inconsistent. Observer Bias: Also known as confirmation bias, the observer's bias is the effect of seeing what you expect or want to see in data. This can happen when researchers go into a project with subjective thoughts about their study, either consciously or unconsciously. You can also see this when labelers let their subjective thoughts control their labeling habits, resulting in inaccurate data. Racial bias: Although the ropes are not biased in the conventional sense, this is still worth mentioning lately due to its prevalence in AI technology. Racial bias occurs when data is distorted in favor of certain demographics. This can be seen in facial recognition and automatic speech recognition technology that doesn't recognize people of color as accurately as Caucasians. Google's Inclusive Images competition provided good examples of how this can happen. Association distortion: This distortion occurs when the data for a machine learning model amplifies and/or multiplies a cultural bias. Your record can have a collection of jobs in which all men are doctors and all women are nurses. This does not mean that women cannot be doctors and men cannot be nurses. However, as far as your machine learning model is concerned, there are no doctors and nurses. Association bias is best known for creating gender bias, as the Excavating AI study showed. How do I avoid data distortion in machine learning projects? Preventing data distortion in machine learning projects is an ongoing process. Although it is sometimes difficult to know when your data or model is distorted, there are a number of steps you can take to prevent distortion or catch it early. Although far from the list below provides an entry-level guide to thinking about data bias in machine learning projects. For best success, research your users in advance. Note your general use cases and potential outliers. Make sure your team of data scientists and data labelers is diverse. If possible, combine input from multiple sources to ensure data diversity. Create a gold standard for your data label. A gold standard is a data set that the ideally labeled data for your task. It allows you to measure your team's notes for accuracy. Provide clear guidelines for data label expectations so that the data labelers are consistent. Use multi-pass annotations for any project where data accuracy may be vulnerable to distortion. Examples include sentiment analysis, content moderation, and intent detection. Get help from people with domain knowledge to review your collected and/or annotated data. Someone from outside your team can see prejudices that your team has overlooked. Analyze your data regularly. Track bugs and problem areas so you can respond quickly and fix them. Analyze data points carefully before deciding to delete or retain them. Make the most biased part of your development cycle. Google, IBM, and Microsoft have all released tools and guides to help analyze distortions for a number of different data types. If you're looking for a deeper insight into how bias occurs, what impact it has on machine learning models, and previous examples of it in automated technology, I recommend reading Margaret Mitchell's presentation Bias in the Vision and Language of Artificial Intelligence. You can take a look at the slides for the presentation here, or watch the video below. In closingIt is important to be aware of the potential distortions in machine learning for each data project. By setting up the right systems early and keeping data collection, labeling, and implementation up-to-date, you can notice this before it becomes a problem, or respond to it when it pops up. Also posted on: Hacker Noon Create your free account to unlock your individual reading experience. Machine learning practitioners have different personalities. While some of them are I'm an expert in X and X can train on any type of data, where X = some algorithm, some others are right tool for the right job people. Many of them also subscribe to Jack of all trades. Master of one strategy, where they have an area with deep know-how and know a little about different areas of machine learning. However, no one can deny the fact that, as practicing data scientists, we need to know the basics of some common machine learning algorithms that would help us deal with a problem we encounter. This a whirlwind tour of common machine learning algorithms and fast resources about them that can help you get started with them.1. Principal Component Analysis (PCA)/SVDPCA is an unattended method for understanding the global properties of a vector dataset. Covariance matrix of data points is analyzed here to understand which dimensions (mostly) / data points are (sometimes) more important (i.e. have a high variance among themselves, but a low covariance with others). One way to think of top PCs in a matrix is to Self-vectors with the highest intrinsically values. SVD is essentially a way to calculate even ordered components, but you don't need to get the covariance matrix of points to get them. Libraries: //scikit-learn.org/stable/modules/generated/sklearn.com.com.htmlIntroductory Tutorial: .. Least Squares and Polynomial FittingRemember Your Numerical Analysis code in college, where you adjust lines and curves to points to get an equation. You can use them to customize curves in machine learning for very small, low-dimension datasets. (For large data or datasets with many dimensions, you can end up overfitting terribly, so it doesn't bother you). OLS has a closed form solution, so you don't have to use complex optimization techniques. As it is obvious, use this algorithm, to customize simple curves/regressionLibraries: //docs.scipy.org/ //docs.scipy.org/doc/numpy-1.10.0/reference/generated/numpy.polyfit.htmlIntroductory Tutorial: . Constrained Linear RegressionLeast squares can be confused with outliers, incorrect fields, and noise in data. We therefore need constraints to reduce the variance of the line that we fit into a dataset. The right way to do it is to fit a linear regression model that ensure that the weights do not behave incorrectly. Models can have L1 (LASSO) or L2 (Ridge Regression) or both (elastic regression). Mean Squared Loss is optimized. Use these algorithms to restrict regression lines and avoid rushing dimensions of model.Libraries: Tutorial(s) . K means clusteringEveryone's preferred unattended clustering algorithm. For a series of data points in the form of vectors, we can create point clusters based on distances between them. It is an expectation maximization algorithm that iteratively moves the centers of clusters and then links points to each cluster center. The input that the algorithm used is the number of clusters to generate and the number of iterations in which clusters should converge. As the name shows, Use this algorithm to create K clusters in datasetLibrary: Tutorial(s): . Logistic RegressionLogregression is limited linear regression with a (Sigmoid function is most commonly used or you can also use tanh) application according to weights, hence the limitation of outputs near +/- classes (that is 1 and 0 in the case of sigmoid). Cross-Entropy Loss features are optimized with Gradient Descent. A note for beginners: Logistic regression is used for classification, not for regression. You can also think of logistic regression as a single-layer neural network. Logistic regression is trained with optimization methods such as Gradient Descent or L-BFGS. NLP people often use it with the name Maximum Entropy Classifier.This is what a sigmoid looks like:Use LR to train simple but very robust classifiers.Library: Tutorial(s): SVM (Support Vector Machines)SVMs are linear models like linear/logistic regression, the difference is that they have different margin-based loss function (derivation of support vectors is one of the most beautiful mathematical results I've seen along with intrinsically calculated). You can optimize the loss function with optimization methods such as L-BFGS or even SGD. Another innovation in SVMs is the use of kernels for data to be a feature engineer. If you have good domain insights, you can replace and benefit from the good old RBF kernel with smarter ones. One unique thing SVMs can do is learn a class. SVMs can be used to create a classifier (also regressors)Library: Tutorial(s) .com/watch?v=eHsErlPJWUUNote: SGD-based sgd-based SGD-based training can be found in both the logistic regression and the SVMs because I can both LR and SVM with a common interface. You can also train it on >RAM records with minibatches.6. Feedforward Neural NetworksThese are basically multi-layered logistic regression classifiers. Many weight layers separated by nonlinearities (Sigmoid, Tanh, Relu + Softmax and the cool new Selu). Another popular name for them is Multi-Layered Perceptrons. FFNNs can be used as autoencoders for classification and unattended feature learning. Multi-Layered perceptronFFNN as autoencoderFFNNs can be used to train a classifier or to use features as autoencodersLibraries iier.html-sklearn.neural_network.MLPClassifier //github.com/keras-team/keras/blob/master/examples/reuters_mlp_relu_vs_selu.pyIntroductory iier.html-sklearn.neural_network.MLPClassifier //github.com/keras-team/keras/blob/master/examples/reuters_mlp_relu_vs_selu.pyIntroductory Convolutional Neural Networks (Convnets)Almost every modern vision-based machine learning result in today's world has been achieved with Convolutional Neural Networks. They can be used for image classification, object recognition, or even segmentation of images. Convnets were invented by Yann Lecun in the late 1980s and have convolutional layers that act as hierarchical feature extractors. You can also use them in text (and even in charts). Libraries: //github.com/kuangliu/torchcv //keras.io/applications/Introductory Tutorial(s):) //adeshpande3.github.io/A-Beginner%27s-Guide-To-Understanding-Convolutional-Neural-Networks/8. Recurrent Neural Networks (RNNs):RNNs model sequences by recursively recursively to the aggregator state at a time t and input at a time t (given that a sequence has inputs at times 0..t. T, and have a hidden state at any time t output by t-1 step of RNN). Pure RNNs are rarely used today, but their counterparts such as LSTMs and GRUs are state-of-the-art in most sequence modeling tasks. RNN (If there is a densely connected unit and a nonlinearity, today f is usually LSTMs or GRUs). LSTM unit used instead of a simple dense layer in a pure RNN. Use RNNs for any sequence modeling task, especially text classification, machine translation, Language modellingLibrary: (many of Google's cool NLP research is here) //opennmt.net/Introductory Tutorial(s): 4d.stanford.edu/ //colah.github.io/posts/2015-08-Understanding-LSTMs/9. Conditional Random Fields (CRFs)CRFs are probably the most commonly used models in the family probabilitic Graphical Models (PGMs). They are used for sequence modeling such as RNNs and can also be used in combination with RNNs. Before neural machine translation systems came into CRFs, the stagnated and in many sequence tagging tasks with small data sets, they will still learn better than RNNs that need a larger amount of data to generalize. They can also be used in other structured prediction tasks, such as image segmentation, and so on. CRF models each element of the sequence (e.B. a set) so that neighbors have a label component in a sequence, rather than all labels being independent of each other. Use CRFs to select sequences (in text, image, time series, DNA, and so on) Library: Tutorial(s): part lecture series by Hugo Larochelle on Youtube: Youtube: Decision TreesSay Say We get an Excel sheet with data about different fruits and I have to tell which look like apples. What I'm going to do is ask a question Which fruits are red and round ? and to share all the fruits that answer yes and no to the question. Well, all red and round fruits can not apples and all apples will not be red and round. So I'm going to ask a question Which fruits have red or yellow color hints on them? on red and round fruits and will ask Which fruits are green and round? on non-red and round fruits. On the basis of these questions, I can say with great accuracy which apples they are. This cascade of questions is what a decision tree is. However, this is a decision tree based on my intuition. Intuition cannot work on high-dimensional and complex data. We need to get the cascade of questions automatically by looking at the marked data. That's what machine learning-based decision trees do. Earlier versions, such as CART trees, were once used for simple data, but with ever-larger datasets, the bias variance compromise needs to be solved with better algorithms. The two common decision tree algorithms used today are Random Forests (which create different classifiers on a random subset of attributes and combine them for output) and Boosting Trees (which train a cascade of trees over others and correct the errors of those among them). Decision trees can be used to classify data points (and even regression)Libraries //scikit-learn.org/stable/module. s/generated/sklearn.ensemble.GradientBoostingClassifier.html //catboost.yandex/Introductory Tutorial: s.io/en/latest/model.html //arxiv.org/abs/1407.7502 Algorithms (Good To Have)If you are still wondering how one of the above methods can defeat tasks like defeating Go World Champion like DeepMind, they cannot. All 10 types of algorithms we talked about before this was pattern recognition, not strategy learner. To learn a strategy to solve a multi-level problem, such as winning a chess game or playing Atari console, we need to leave an agent-free in the world and learn from the rewards/penalties to which he is exposed. This type of machine learning is called amplification learning. Many (not all) of recent successes in this area are the result of the combination of a monastery or LSTM with a set of algorithms called Temporal Difference Learning. These include Q-Learning, SARSA and some other variants. These algorithms are an intelligent game on Bellman's equations to get a loss function that can be trained with rewards that an agent receives from the environment. These algorithms are used to :D Libraries: //github.com/tensorflow/minigoIntroductory Tutorial(s):Grab the free Sutton and Barto book: gdicaro/15381/additional/SuttonBarto-RL-5Nov17.pdfWatch David Silver course: are the 10 machine learning algorithms that you can learn to become a data scientist. You can also read about Machine Learning libraries here. We hope you liked the article. Please sign up for a free ParallelDots account to start your AI journey. You can also check the demos of our APIs here. Read the original article here. Join Hacker Noon Create your free account to unlock your individual reading experience. Experience.

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