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COMMENTARY

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Predictive Methods for Surgical Time during Surgery

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Description

To arrange planned and elective procedures and maximise the operating room's usage rate, Surgery Duration predictions (SD) are used (maximized subject to policy constraints). An example of a limitation is the need that a predetermined tolerance for the proportion of procedures that must be postponed because there isn't enough capacity in the Operating Room (OR) or recovery room not be surpassed. Because of the close relationship between SD prediction and operation scheduling, scientific study on scheduling techniques frequently includes an examination of SD predictive techniques, and vice versa. It is well known that surgical times vary greatly. As a result, SD predictive approaches make an effort to both reduce variability (via stratification and variables, as will be discussed later) and use the best techniques currently available to provide SD predictions. A greater the better the projections, the better the timing of operations (in terms of the required OR utilisation optimization).

The optimal outcome of an SD prediction approach would be a predicted SD statistical distribution (specifying the distribution and estimating its parameters). The most likely length (mode) or likelihood that the SD will not exceed a given threshold value, for example, can be retrieved from the SD distribution once it has been fully described. In less ambitious situations, the predictive approach would at least be able to forecast some of the distribution's fundamental characteristics, such as its position and size factors (mean, median, mode, standard deviation or coefficient of variation), CVIt is also possible for estimation and prediction to aim for specific desirable percentiles of the distribution. The ideal goal of fully describing the SD theoretical distribution is frequently replaced by expert judgement, empirical histograms of the distribution (based on past computer records), data mining, and knowledge discovery approaches.

Predictive models and methods

Here is a sample (not full) list of models and techniques used to generate SD forecasts (in no particular order). The sample of representative references below includes some of these, or a combination of them: Machine learning; Data mining (rough sets, neural networks); Random forests; Multivariate Adaptive Regression Splines (MARS); databases for knowledge discovery; Data warehouse model, Jackknife, KDE, and Monte Carlo simulation are used to extract data from numerous, sometimes unrelated datasets.

As was already said, a popular view of the SD predictive approach includes reducing SD variability prior to prediction. SD distribution may be impacted by a variety of linked elements, suggesting that it contains a systematic component in addition to random variance (like medical specialty, patient condition or age, professional experience and size of medical team, number of surgeries a surgeon has to perform in a shift, type of anaesthetic administered). Incorporating these variables (through stratification or covariates) would reduce SD variability and improve the predictive method's precision. Including expert opinions, such as those of surgeons, in the predictive model may also help to reduce the degree of uncertainty in the prediction of SD based on data. Often, statistically significant covariates (also related to as factors, predictors or explanatory variables)—are first identified (for example, via simple techniques like linear regression and knowledge discovery), and only later more advanced big-data techniques are employed, like Artificial Intelligence and Machine Learning, to produce the final prediction.

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