Tactile gating

Tactile gating refers to the reduction in tactile perception that occurs during movement.

It suppresses redundant movement-related feedback that can be predicted from the motor command so that the perception of unexpected or novel inputs is enhanced. The central motor command plays a key role in generating tactile suppression. Peripheral feedback from the moving limb also contributes because tactile suppression is seen during passive movement, i.e. in the absence of a motor command.

Chapman, E., & Tremblay, F. (n.d.). Tactile suppression. Scholarpedia. Retrieved December 9, 2022, from http://www.scholarpedia.org/article/Tactile_suppression

Cuticular Wax

Cuticular wax is a hydrophobic layer composed of lipid soluble compounds that envelope plant tissues that are above the soil (plant aerial tissues), including the stems, leaves, petioles, flowers, fruit and seeds. This wax layer allows the plant to interact with the outer environment.

Also, it is useful in reducing water loss that is not due to photosynthesis (non-stomatal water loss) and the plant temperatures (canopy temperatures). Hence, it serves as a physical barrier to protect the plants from desiccation, diverse biotic and abiotic stresses.

Xue, D., Zhang, X., Lu, X., Chen, G., & Chen, Z.-H. (2017, April 6). Molecular and evolutionary mechanisms of cuticular wax for plant drought tolerance. Frontiers. Retrieved December 9, 2022, from https://www.frontiersin.org/articles/10.3389/fpls.2017.00621/full

Peripheral Nerve Blocks

Peripheral nerve blocks are usually used for surgical anesthetics by injecting a local anesthetic near the nerve controlling sensation or movement to the area of the body requiring surgery. They also serve as alternatives to general anesthesia and central nerve blocks for surgery.

Compared to traditional surgical anesthetics, the risk of post-operative fatigue and vomiting is reduced. It is also proven that patients often require less pain medication during post-operation when a peripheral nerve block was used in surgery. This is because a peripheral nerve block only affects the area of the body being operated on and patients have an option to stay awake or be asleep during the procedure.

Peripheral Nerve Blocks. The Surgery Center of Middle Tennessee. (n.d.). Retrieved December 9, 2022, from https://surgerycenterofmidtn.com/procedure/peripheral-nerve-blocks

Secondary finding

Secondary findings are genetic test results that provide information about mutations of genes (variants) that are not directly related to the primary purpose for the testing. For instance, secondary findings like the discovery of new cancer predispositions leading to interrogation of genes traditionally thought to be unrelated to cancer.

This raises an ethical question that should clinician purposefully discover secondary findings on patients if the primary findings do not show any sign of abnormality. On one hand, these findings help prevent a disease from occurring or reveal symptoms if the disease develops or is already present. On the other hand, just like any type of medical diagnosis, the disclosure of an unexpected potential health problem may lead to additional health costs and stress for the patients.

U.S. National Library of Medicine. (n.d.). What are secondary findings from genetic testing? MedlinePlus. Retrieved December 9, 2022, from https://medlineplus.gov/genetics/understanding/testing/secondaryfindings/

Pathogenic variant

A pathogenic variant (mutation) is a genetic alteration that increases an individual's risks to a certain medical condition. When a pathogenic variant is present in an individual's body, their development of symptoms has been proved through sufficient scientific research is, if not certain, more likely. An example of such is the breast-cancer-associated variant rs3903072. As for variants that are probably related to causing disease but there is not enough scientific proof to be pathogenic are categorized as Likely pathogenic. Note that not all variants are pathogenic. In fact, only a small percentage of variants cause genetic disorder while most of them have no impact on health or development.

NCI Dictionary of Genetics terms. National Cancer Institute. (n.d.). Retrieved December 9, 2022, from https://www.cancer.gov/publications/dictionaries/genetics-dictionary/def/pathogenic-variant

U.S. National Library of Medicine. (n.d.). Do all gene variants affect health and development? MedlinePlus. Retrieved December 9, 2022, from https://medlineplus.gov/genetics/understanding/mutationsanddisorders/neutralmutations/

Non-parametric statistics

Non-parametric statistics is a type of statistics that is not based on any probability distribution with specified parameters such as mean, standard deviation and variance. They are either distribution-free or carry a specified distribution but with the distribution's parameters flexible and not fixed in advance. Non-parametric methods are used to study populations with a ranked order while numerical interpretation is not required. Hence, the results are often ordinal data. Compared to parametric methods, non-parametric methods require less assumptions and thus are more applicable and are more robust. However, non-parametric tests have less statistical power for cases where parametric tests are applicable. Consequently, a larger sample size is required to draw conclusions with the same degree of confidence as the parametric tests. Examples of nonparametric models include histogram, kernel density estimation, nonparametric regression.

Example:

A researcher wants to predict how frequently one falls ill based on their average hours of sleep. In reality, most healthy people get sick rarely while people with terminal illness get sick far more often than most others. Hence, the distribution of illness frequency is clearly non-normal. Therefore, instead of using a method that assumes a normal distribution for illness frequency, such as linear regression analysis, the researcher should use a nonparametric method like quantile regression analysis.

Wikimedia Foundation. (2022, October 15). Nonparametric statistics. Wikipedia. Retrieved December 9, 2022, from https://en.wikipedia.org/wiki/Nonparametric_statistics

Two sample T-test

It is a statistical method to test whether the means of two independent groups from the population are statistically different. To use this test, the following assumptions have to be fulfilled:

1. Each observation must be independent: measurements for one observation do not affect measurements for any other observation.
2. The sample is obtained through random sampling from the population.
3. The observations in each group come from a normal distribution population.
4. Data values are continuous.
5. The variances for the two independent groups are equal.

Example:

A researcher wants to compare the amount of protein in energy bars from two different brands. Here, the two groups for comparison are the two brands and the measurements are the grams of protein for each energy bar. To test the research hypothesis that the mean grams of protein for the underlying populations for the two brands are different, we can conduct two sample t-test. If the p-value of the t-test is statistically significant, we have evidence that the mean grams of protein for the two brands of energy bars is different.

Kumar, A. (2022). Two-sample T-test. JMP. Retrieved October 17, 2022, from https://www.jmp.com/en_ca/statistics-knowledge-portal/t-test/two-sample-t-test.html

Logistic Regression

Logistic regression can be used to model and solve binary classification problems. That is, given a predictor x (it can be continuous or discrete), we can use logistic regression model to predict the value of a categorical response variable y which consists of only two classes. Instead of visualizing the model as a straight line like linear regression, logistic regression model fits a 'S' shaped 'logistic function' to the data and the curve goes from 0 to 1.

Starmer, J. (2018, March 5). StatQuest: Logistic regression. YouTube. Retrieved October 6, 2022, from https://www.youtube.com/watch?v=yIYKR4sgzI8

One-way ANOVA

ANOVA (ANalysis Of VAriance) is a statistical test to determine if the group means are significantly different from each other by comparing the variances of individual groups. The null hypothesis for ANOVA is all group means are equal. Hence, if the mean of any group does not match with the remaining groups, the test is regarded as statistically significant. We can then reject the null hypothesis and suggest that the groups do not have equal means. In one-way ANOVA, the sample data is categorized into several groups based on one single grouping variable (factor variable). Note that ANOVA is an extension of two-sample t-test by allowing the number of compared groups to be more than 2 groups. In particular, if we are only comparing means of two groups, ANOVA and two-sample t-test are equivalent.

To use One-way ANOVA, the following assumptions should be fulfilled:

- All observations, regardless of their associated groups, are independent of one another.
- The observations in each group come from a normal distribution population.
- The distribution of means in each group share the same variance.

Kumar, A. (2022, February 16). One-way ANOVA test: Concepts, Formula & Examples. Data Analytics. Retrieved October 17, 2022, from https://vitalflux.com/one-way-anova-test-concepts-formula-examples/#R eal-world_examples_of_One-way_ANOVA_test

Tableau

Tableau is an interactive business intelligence data visualization tool which allows users to explore data in simple methods such as drag and drop. It is a user-friendly software since most of the functions in Tableau do not require coding skills. Users can import huge dataset in various forms (Excel, JSON, etc.) to the software and connect the final reports to online servers like Microsoft SQL, My SQL, etc.

Under “Sheet page”, there are:

- Data section

  All variables are listed, and they are automatically separated into discrete variables (indicated with blue color) and continuous variables (indicated with green color).

- Work view section

  Users can drag variables from Data section to “column” and “row” to format their table.

- Analytic section

Simple Statistic models are ready to be used with no codes required.

- Card section

  Users can drag variables to the “Filter” card and the table will only show the variables that are chosen. Under the “Mark” card, there are color, size, label, detail, tooltip functions. These functions are useful in adjusting the visualization and interactions of the tables. For example, one can drag a continuous variable to the color function and the table will display the data with colors instead of numbers.

Users can combine many sheets and display them on one dashboard page. For projects with multiple dashboards, users can save the dashboards under a workbook, and it will be ready for publication on websites or servers.

However, there are some weaknesses in Tableau. For instance, there is a restriction on Screen Resolution on Tableau Dashboards. The layout of the dashboards depends on the Tableau developer screen resolution. Therefore, it may be displayed differently on the users' screen if they have different screen resolution. For example, if the dashboard is created on the screen resolution of 1920 X 1080 but it is viewed on a 2560 X 1440 screen, the layout of the dashboard will be destroyed and hence not responsive. Therefore, developers usually need to create a dashboard for desktop and mobile separately.

Introduction to Tableau. (2022, November). Tableau Visualization information workshop for ISSC.