Editorial

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# Different statistical approaches in liver diseases from conventional vision to disease prediction

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## Editorial

In this editorial, we compared conventional statistical analysis of liver disease data with neural network analysis to predict which risk factors are more important in the prediction of liver diseases. Usually, liver function tests are used to assess liver diseases. These risk factors include, but not restricted to, ALT, AST, total bilirubin and direct bilirubin, total proteins, alkaline phosphatase, and albumin. Some demographical characteristics are also included such as age and gender.

Conventional statistical analysis modes include descriptive analysis such as frequency, percentages, mean, and standard deviations. The relationships between study variables can be assessed using the difference in means such as T test, and One Way ANOVA. Correlations and regressions can also be used to give in depth sights of the liver diseases. The output of these analyses is well known.

With the development of science, machine learning or artificial intelligence has been created to simulate the way of brain activities in thinking. Much progress has been made such as the prediction mode. In this mode of analysis, datasets for various diseases have been created including diabetes, heart, and liver. In general, datasets are designed to have output of two classifications as either diseased or not diseased. The datasets have the data of risk factors, or predictors of liver disease. The artificial intelligence part of this data implies thinking as human brain does. There are three layers in the artificial intelligence, input layer (predictors), hidden layers, and output layer. The system will run many times to give a prediction of which predictors are most important. In the following example, a comparison between conventional and artificial network analysis was made for the same liver disease dataset. Table 1 showed the general characteristics of study variables including frequency, percentage for categorized variables, and mean and standard deviation for non-categorized variables. Table 2 showed the relationships between study variables using independent T test. This test can provide important information including mean, standard deviation, and significance. When significance is equal, it is difficult to determine the relative importance of each predictor.

**Table 1** General description of study variables

| Variable | Description |
|---|---|
| Age (M±SD) years | 44.75 (16.19) |
| Gender (N, %): | |
| - Males | 441 (75.6%) |
| - Females | 142 (24.4%) |
| Total bilirubin (M±SD) mg/dl | 3.30±6.21 |
| Direct bilirubin (M±SD) mg/dl | 1.49±2.81 |
| Alkaline phosphatase (M±SD) IU/L | 290.58±242.4 |
| ALT (M±SD) IU/L | 80.71±182.62 |
| AST (M±SD) IU/L | 109.91±288.92 |
| Total protein (M±SD) g/dl | 6.48±1.09 |
| Albumin (M±SD) g/dl | 3.14±0.80 |
| Albumin/globulin (%) | 0.974±0.32 |
| Health status (N, %): | |
| - Diseased | 416 (71.4%) |
| - Normal | 167 (28.6%) |

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**Table 2** The relationships between study variables using independent T test

| Variable | Dataset | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|---|
| Age | Disease | 416 | 46.15 | 15.65 | 0.001 |
| | Normal | 167 | 41.24 | 16.99 | |
| Total bilirubin | Disease | 416 | 4.16 | 7.14 | 0.000 |
| | Normal | 167 | 1.142 | 1.00 | |
| Direct bilirubin | Disease | 416 | 1.92 | 3.20 | 0.000 |
| | Normal | 167 | 0.39 | 0.52 | |
| Alkaline phosphatase | Disease | 416 | 319.00 | 268.30 | 0.000 |
| | Normal | 167 | 219.75 | 140.98 | |
| ALT | Disease | 416 | 99.60 | 212.76 | 0.000 |
| | Normal | 167 | 33.65 | 25.06 | |
| AST | Disease | 416 | 137.69 | 337.38 | 0.000 |
| | Normal | 167 | 40.68 | 36.41 | |
| Total protein | Disease | 416 | 6.45 | 1.09 | 0.399 |
| | Normal | 167 | 6.54 | 1.06 | |
| Albumin | Disease | 416 | 3.06 | 0.78 | 0.000 |
| | Normal | 167 | 3.34 | 0.78 | |
| Albumin/globulin_ratio | Disease | 414 | 0.91 | 0.33 | 0.000 |
| | Normal | 165 | 1.03 | 0.29 | |

Using artificial intelligence gives various figures and tables of which Table 3 showed the importance of independent variables. In this table, the importance is given as proportions and percentages. In Figure 1, normalized importance is given according to their importance.

**Table 3** The importance of independent variables

| | Importance | Normalized importance |
|---|---|---|
| Age | .063 | 33.9% |
| Total bilirubin | .099 | 53.6% |
| Direct bilirubin | .121 | 65.7% |
| Alkaline phosphatase | .053 | 28.9% |
| AST | .169 | 91.6% |
| ALT | .185 | 100.0% |
| Total protein | .109 | 58.9% |
| Albumin | .144 | 78.1% |
| Albumin/globulin ratio | .056 | 30.4% |

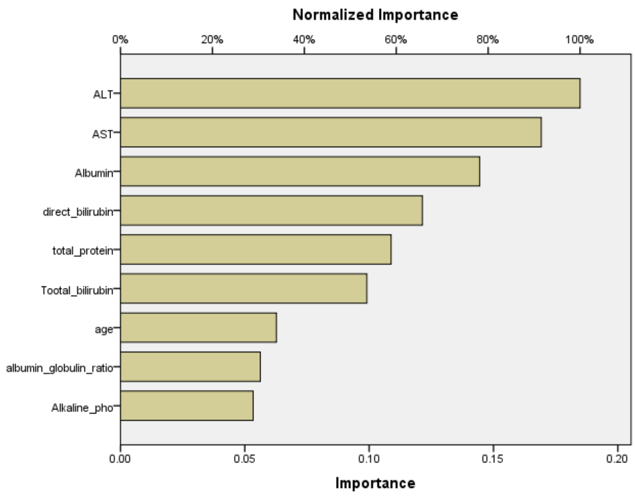


**Figure 1** Normalized importance of covariates on liver disease.

## Conclusion

Although conventional statistical analysis of liver data can provide important information about liver state conditions, appropriate prediction of health and disease requires neural network analysis.

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