Hellenic Complex Systems Laboratory

Relation of Positive and Negative Predictive Values of Diagnostic Tests

Technical Report XII

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WOLFRAM Demonstrations Project

Relation of Positive and Negative Predictive Values of Diagnostic Tests

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Search Terms: sensitivity, specificity, diagnostic test, clinical accuracy, diagnostic accuracy, normal distribution, positive predictive value, negative predictive value

Short Description of the Demonstration

This Demonstration examines the relation of the negative predictive value (NPV) and the positive predictive value (PPV) of a diagnostic test for normally distributed nondiseased and diseased populations. Differing levels of prevalence of the disease are considered. The mean and standard deviation of the populations, measured in arbitrary units, are used.

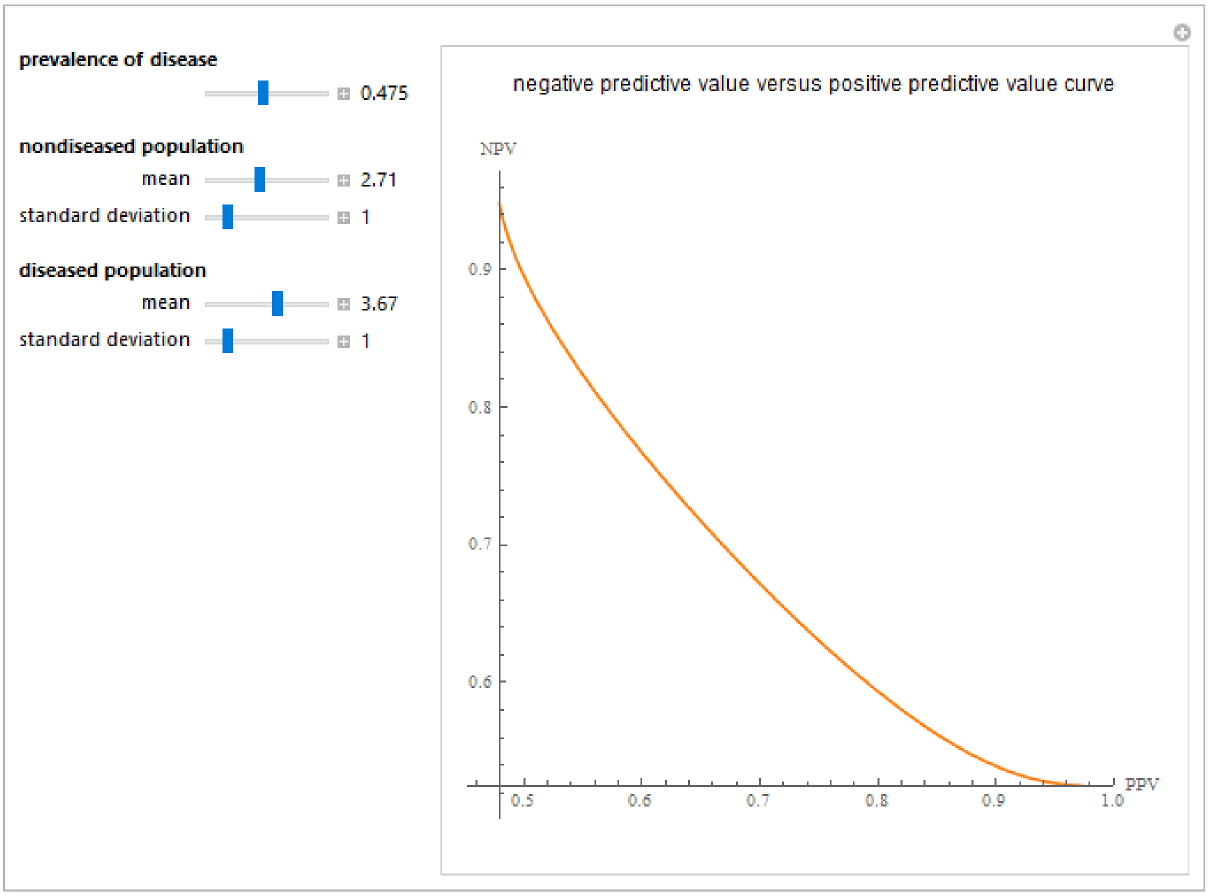

Figure 1: *Negative predictive value versus positive predictive value curve plot of a diagnostic test, with the settings shown at the left.*

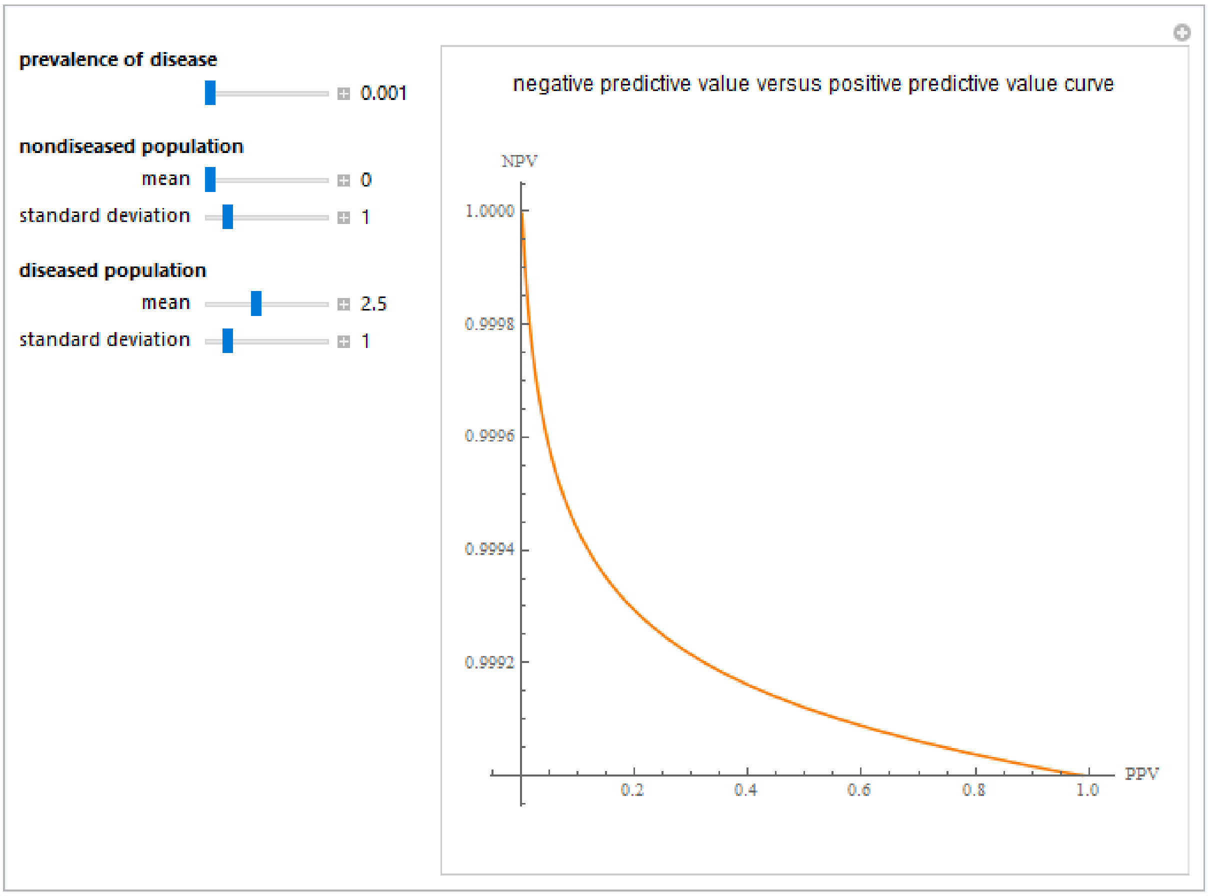

Figure 2: *Negative predictive value versus positive predictive value curve plot of a diagnostic test, with the settings shown at the left.*

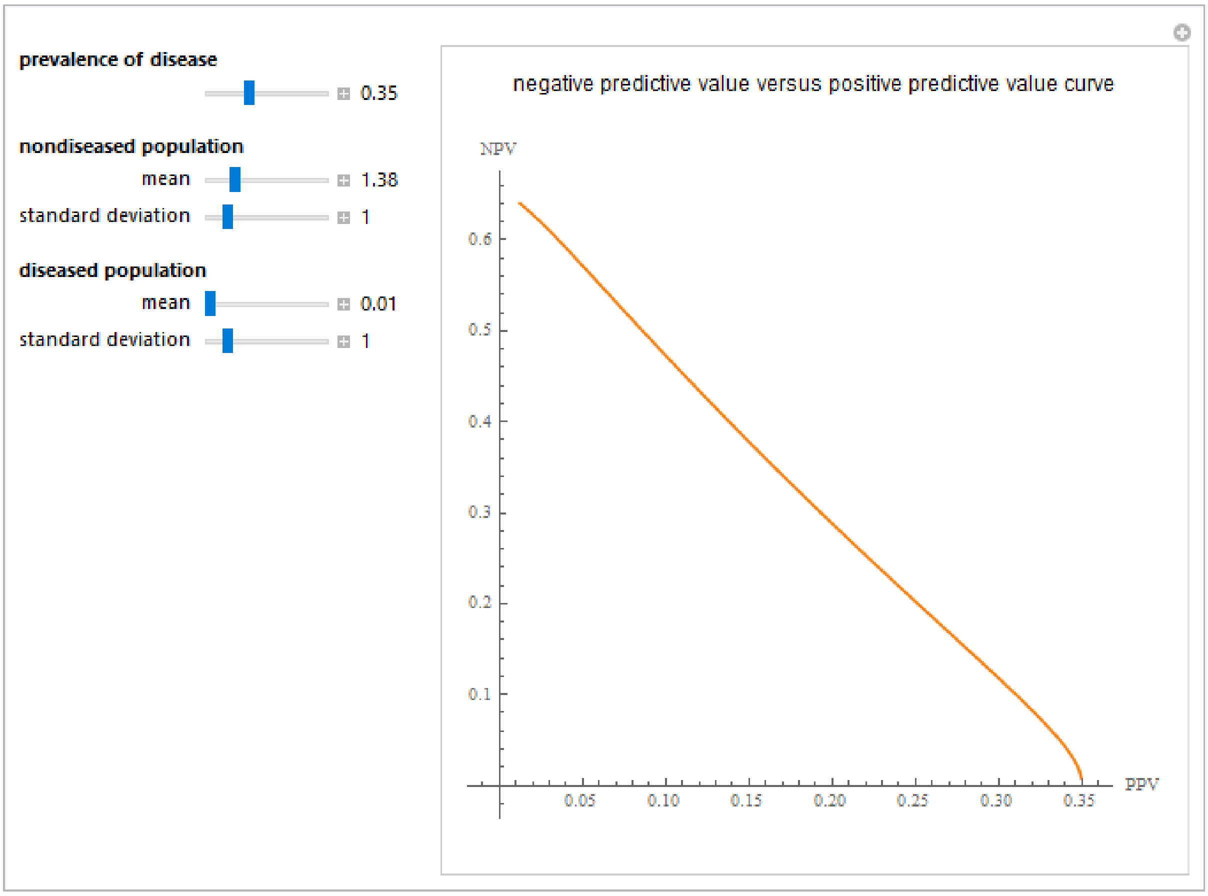

Figure 3: *Negative predictive value versus positive predictive value curve plot of a diagnostic test, with the settings shown at the left.*

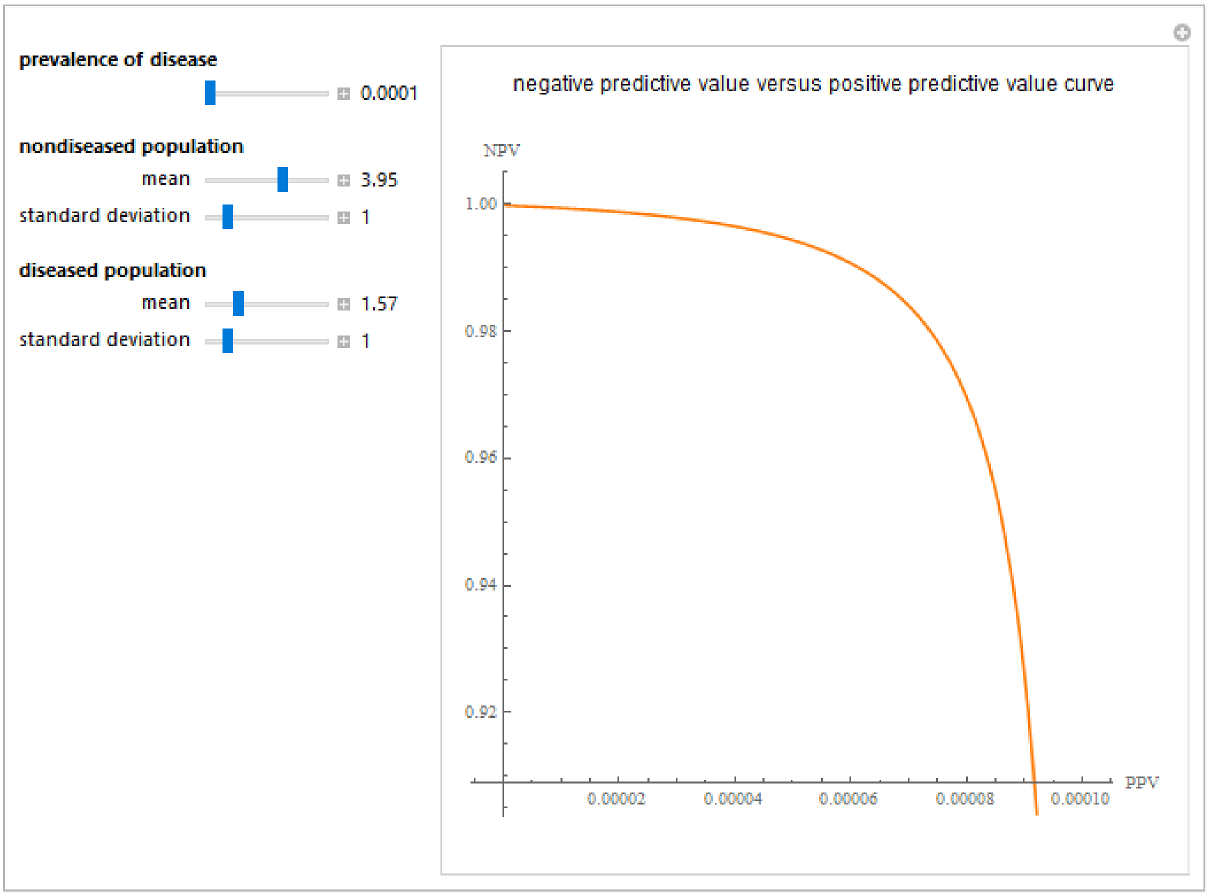

Figure 4: *Negative predictive value versus positive predictive value curve plot of a diagnostic test, with the settings shown at the left.*

Details

The PPV and NPV that are used in the evaluation of the clinical accuracy of a diagnostic test applied to a diseased or nondiseased population can be calculated given the sensitivity and specificity of the test. Sensitivity is the fraction of the diseased population with a positive test, while specificity is the fraction of the nondiseased population with a negative test. If we denote by *sens* the sensitivity, *spec* the specificity, and *pr* the prevalence, then:

$$PPV = \frac{sens \times pr}{sens \times pr + (1 - spec)(1 - pr)}$$

$$NPV = \frac{spec\ (1 - pr)}{spec\ (1 - pr) + (1 - sens)\ pr}$$

Given a diseased and a nondiseased population, the specificity can be defined as a function of sensitivity; therefore, we can plot PPV versus NPV (a parametric plot).

The population data in the figures describes a bimodal distribution of serum glucose measurements in nondiabetic and diabetic populations [1].

This Demonstration is based on [2].

References

[1] T.-O. Lim, R. Bakri, Z. Morad and M. A. Hamid. Bimodality in Blood Glucose Distribution: Is It Universal? *Diabetes Care,* **25**(12), 2002 pp. 2212–2217. doi:10.2337/diacare.25.12.2212.

[2] A. T. Hatjimihail. Uncertainty of Measurement and Diagnostic Accuracy Measures. Wolfram Demonstrations Project, Champaign: Wolfram Research, Inc., 2009. Available at: http://demonstrations.wolfram.com/UncertaintyOfMeasurementAndDiagnosticAccuracyMeasures/

Note

In the Technical Report, the term "correlation" has been updated to "relation", while it remains as "correlation" in the Wolfram Demonstrations Project related title, documents and citation.

Source Code

Programming language: Wolfram Language

Availability: The updated source code is available at: https://www.hcsl.com/Tools/Demonstrations/CorrelationOfPositiveAndNegativePredictiveValuesOfDiagnostic.nb

Software Requirements

Operating systems: Microsoft Windows, Linux, Apple macOS and iOS

Other software requirements: Wolfram Player®, freely available at: https://www.wolfram.com/player/ or Wolfram Mathematica®.

System Requirements

Processor: x86-64 compatible CPU.

System memory (RAM): 4GB+ recommended.

Permanent Citation:

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