USER MANUAL

Domain: Movement Disorder Diagnosis

Application Name: Determination of Movement Disorder Diagnosis Test Utility in Netica.

Abstract:

Probabilistic Movement Disorder Diagnosis Bayesian Network, gives the probability of the possibility having a certain movement disorder. The probability of having the disorder is ascertained by the inputs given by the user. This Bayesian network gives the probability of having namely four movement disorders i.e. Wilson's Disease, Parkinson's Disease, Essential Tremor and Spasticity. The nodes for Wilson's Disease, Parkinson's Disease, Essential Tremor and Spasticity are placed in the middle. The factors that cause these disorders are placed in the nodes above. The symptoms of these diseases are placed in the nodes below. For example, for the disorder Wilson's disease, the node **Wilson's Disease** is placed in between. The nodes **Age** and **Hereditary Movement Disorder** are placed above the node **Wilson's Disease. Age** and **Hereditary Movement Disorder** are the factors that may cause the disorder. **Fatigue**, **Jaundice**, **Golden Brown Eye Discoloration** and **Stiffness** nodes are placed below the node Wilson's Disease. These are the symptoms of the disorder.

The utility node and the decision nodes are also incorporated in this network which determines the utility, of the movement disorder test, if it is required or is unnecessary.

The four movement Disorders are connected to another nature node, **Presence of Movement Disorder** which determines the probability of the presence of a movement disorder. This is connected to the decision node **Movement Disorder Test**. Both these nodes are connected to the utility node, **Test Effectiveness**. The belief bars in the decision node determines the utility of the actions, Test Required or Unnecessary. **The goal of this application is to determine the utilities of the actions, if a movement disorder diagnosis test is required or unnecessary, based on the above described factors.**

Note:

The pre-set probabilities in the network has been set randomly. The probability of having a particular disorder changes based on the inputs given by the user.

Features:

- The application is designed to determine the utility of the actions, if the movement disorder Test is Required or Unnecessary.
- The application ascertains the probability of having a certain movement disorder using Bayesian network in Netica.
- The probability of having a particular movement disorder changes based on the user's selection of states in the nodes.
- The movement disorders in this network are Wilson's Disease, Parkinson's Disease, Essential Tremor and Spasticity.
  1. **Wilson's Disease:** Genetic disorder in which copper builds up in the body.
     - Causes: **Age, Hereditary**
     - Symptoms: **Fatigue, Jaundice, Golden Brown Eye Discoloration and Stiffness.**
  2. **Parkinson's Disease**: Condition in which parts of the brain gets damaged progressively.
     - Causes:
       Age: Increases as the age increases.
       Gender: The probability of men having this disorder is higher.
       Exposure To Pesticides: Higher Exposure to pesticides increases the probability of having the disorder.

Trichloroethylene Exposure: Increased exposure will increase the chances of this disorder.
Head Injury: If the patient has had a head injury, the chances of having Parkinson's disease increases.

- Symptoms: **Fatigue, Tremor Present at Rest, Jaundice, Bloody Stool, Slowness, Stiffness.**

3. **Essential Tremor**:
   - Causes:
     Age: As age increases the chances of this disorder increases.
     Hereditary Movement Disorder: If the previous generations had this disorder, the chances of the patient having the disorder increases.
   - Symptoms: **Tremor During Activity, Uncontrollable shaking**
4. **Spasticity**:
   - Causes:
     Gender: Females have a higher probability of this disorder.
     Stroke: The chances of Essential Tremor increases with stroke.
     Spinal cord Injury: The chances of the disorder increases if they patient has had a spinal cord injury in the past.
     Stress Level: The probability of Essential Tremor increases with the level of stress.
   - Symptoms: **Postural Abnormality, Muscle Tightness, Muscular Spasm**
5. **Presence of Movement Disorder:**
   - Connected to all four movement disorders, it determines the probability of having a movement disorder.
6. **Movement Disorder Test (Decision Node):**
   - It is a decision node. The link from **Presence of Movement Disorder,** implies the probability of having the disorder is already known at the time of decision making.
7. **Test Effectiveness (Utility Node):** It is a utility node, it evaluates the decision if a movement disorder test is Required or Unnecessary based on the nodes **Presence of Movement Disorder** and **Movement Disorder Test.**

Probabilities and Node Description:

The probability of having the moving disorders, Wilson's Disease, Parkinson's Diseases, Essential Tremor and Spasticity, and the utility of the action movement disorder test, Required or Unnecessary can be determined from this application. In this section, the probability assigned and the logical connection between the different nodes are explained. Each of the four movement disorders namely, Wilson's Disease, Parkinson's Diseases, Essential Tremor and Spasticity are connected to their respective causes and symptoms.

- Wilson's Disease Node is connected to its causes, **Age, Hereditary** and its symptoms **Fatigue, Jaundice, Golden Brown Eye Discoloration and Stiffness.**
- The Age Node has the states, Age10to30, Age30to60, Age60to90, Above90.It can be noticed that as the age increases the probability of Wilson's Disease also increases.
- The Hereditary Movement Disorder Node has the states Yes and No. The probability of Wilson's Disease increases if the state Yes is chosen and decreases if No is chosen.
- The Yes state in the Node Fatigue increases in probability if Wilson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Fatigue Node, the probability of Wilson's disease increases. If No is chosen, the probability decreases.

- The Yes state in the Node Jaundice increases in probability if Wilson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Jaundice Node, the probability of Wilson's disease increases. If No is chosen, the probability decreases.
- The Yes state in the Node Golden Brown Eye Discoloration increases in probability if Wilson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Golden Brown Eye Discoloration Node, the probability of Wilson's disease increases. If No is chosen, the probability decreases.
- The Yes state in the Node Stiffness increases in probability if Wilson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the stiffness Node, the probability of Wilson's disease increases. If No is chosen, the probability decreases.
- Parkinson's Disease Node is connected to its causes, **Age, Gender, Exposure to Pesticides, Trichloroethylene Exposure and Head Injury** and its symptoms **Fatigue, Tremor Present at Rest, Jaundice, Bloody Stool, Slowness, Stiffness.**
- The Age Node has the states, Age10to30, Age30to60, Age60to90, Above90.It can be noticed that as the age increases the probability of Parkinson's Disease also increases.
- The Gender Node has the states, Female and Male. Males have a higher probability of Parkinson's Disease. It can be noticed that if Male is chosen the probability of Parkinson's Disease increases.
- The Exposure to Pesticides Node has the states, No, Marginally and Yes. It can be noticed that as the Exposure to Pesticides increases the probability of Parkinson's Disease also increases.
- The Trichloroethylene Exposure Node has the states, No, Marginally and Yes. It can be noticed that as the Trichloroethylene Exposure increases the probability of Parkinson's Disease also increases.
- The Head Injury Node has the states Yes and No. If Yes is chosen, the probability of having Parkinson's Disease increases.
- The Yes state in the Node Jaundice increases in probability if Parkinson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Jaundice Node, the probability of Parkinson's disease increases. If No is chosen, the probability decreases.
- The Yes state in the Node Fatigue increases in probability if Parkinson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Fatigue Node, the probability of Parkinson's disease increases. If No is chosen, the probability decreases.
- The Yes state in the Node Slowness increases in probability if Parkinson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Slowness Node, the probability of Parkinson's disease increases. If No is chosen, the probability decreases.
- The Yes state in the Node Stiffness increases in probability if Parkinson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Stiffness Node, the probability of Parkinson's disease increases. If No is chosen, the probability decreases.
- The Yes state in the Node Bloody Stool increases in probability if Parkinson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Jaundice

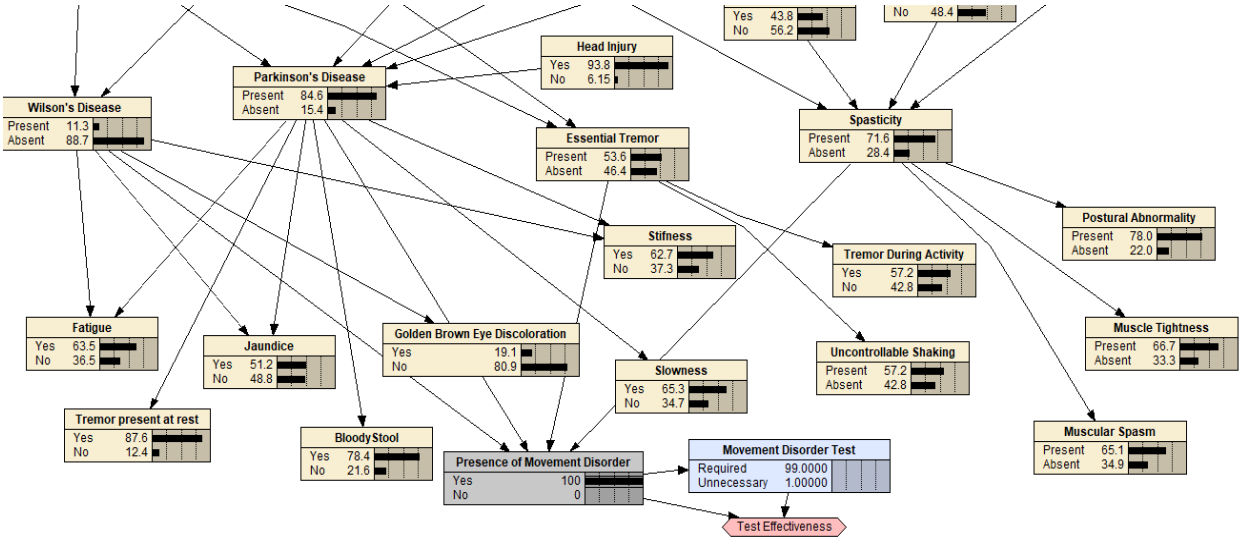
Node, the probability of Parkinson's disease increases. If No is chosen, the probability decreases.

- The Yes state in the Node Tremor Present At Rest increases in probability if Parkinson's Disease is present. It has the states Yes and No. Similarly, If Yes is chosen in the Tremor Present At Rest Node, the probability of Parkinson's disease increases. If No is chosen, the probability decreases.
- Essential Tremor Node is connected to its causes, **Age, Hereditary Movement Disorder** and its symptoms **Uncontrollable Shaking and Tremor during Activity.**
- The Age Node has the states, Age10to30, Age30to60, Age60to90, Above90.It can be noticed that as the age increases the probability of Essential Tremor also increases.
- The Hereditary Movement Disorder Node has the states Yes and No. The probability of presence Essential Tremor increases if the state Yes is chosen and decreases if No is chosen.
- The Present state in the Node Uncontrollable Shaking increases in probability if Essential tremor is present. It has the states Present and Absent. Similarly, If Present is chosen in the Uncontrollable Shaking Node, the probability of Essential Tremor increases. If No is chosen, the probability decreases.
- The Yes state in the Node Tremor During Activity increases in probability if Essential Tremor is present. It has the states Yes and No. Similarly, If Yes is chosen in the Essential Tremor Node, the probability of Essential Tremor increases. If No is chosen, the probability decreases.

- Spasticity Node is connected to its causes, **Gender, Stroke, Spinal Cord Injury, Stress Level** and its symptoms **Postural Abnormality, Muscle Tightness and Muscular spasm.**
- Gender node has the states Male and Female. Females have a higher possibility of Spasticity.
- Stroke Node has the states Yes and No. If the state Yes is chosen, the probability of the presence of Spasticity increases. If No is chosen, the probability of the presence of spasticity decreases.
- Spinal Cord Injury Node has the states Yes and No. If the state Yes is chosen, the probability of the presence of Spasticity increases. If No is chosen, it decreases.
- Stress Level Node has the states Low, Moderate and High and the probability of presence of Spasticity increases as the Stress Level goes from Low to High.
- Postural Abnormality node has states Present and Absent. If Present is chosen, the probability of presence of Spasticity increases. If No is chosen, it decreases.
- Muscle Tightness node has states Present and Absent. If Present is chosen, the probability of presence of Spasticity increases. If No is chosen, it decreases.
- Muscular Spasm node has states Present and Absent. If Present is chosen, the probability of presence of Spasticity increases. If No is chosen, it decreases.
- The four movement disorders are connected to another nature node, **Presence of a Movement Disorder,** which determines the probability of having the movement disorder.
- The above node is connected to the decision node **Movement Disorder Test,** which has states Required and Unnecessary**.**
- The above two nodes are connected to **Test Effectiveness**, which determines the utility of doing the movement disorder test.

User Manual-Instructions to run the application

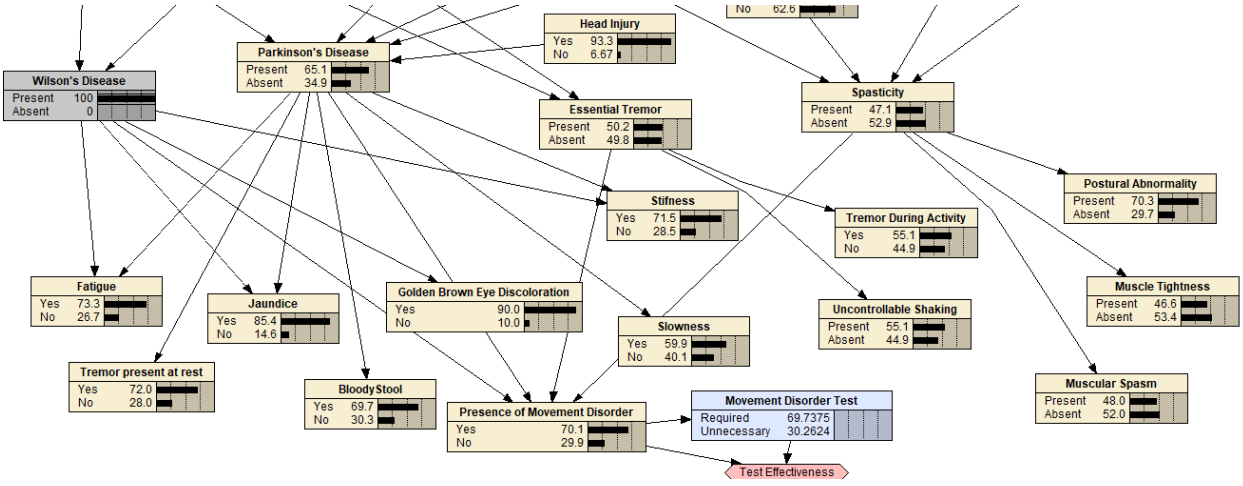
- Open “MovementDisorderTestUtility.neta” file in Netica.
- Check if bars are present in the nodes. If it is present, the nodes are already compiled. If the bars are absent, compile the network by pressing the compile button.
- **To compile the <u>active</u> Bayes net, choose Network → Compile, or click the toolbar button.**
- After Compilation, choose the appropriate states from the cause nodes and the symptom nodes to estimate the probability of the presence of the respective movement disorder.
- See how the utilities of the action if the test required or is unnecessary changes, as shown in the belief bars of **Movement Disorder Test** node when the probabilities of having different movement disorder changes.
- For Example, the following shows the utility of the action Movement Disorder Test when the Yes state in the presence of movement disorder node is chosen.



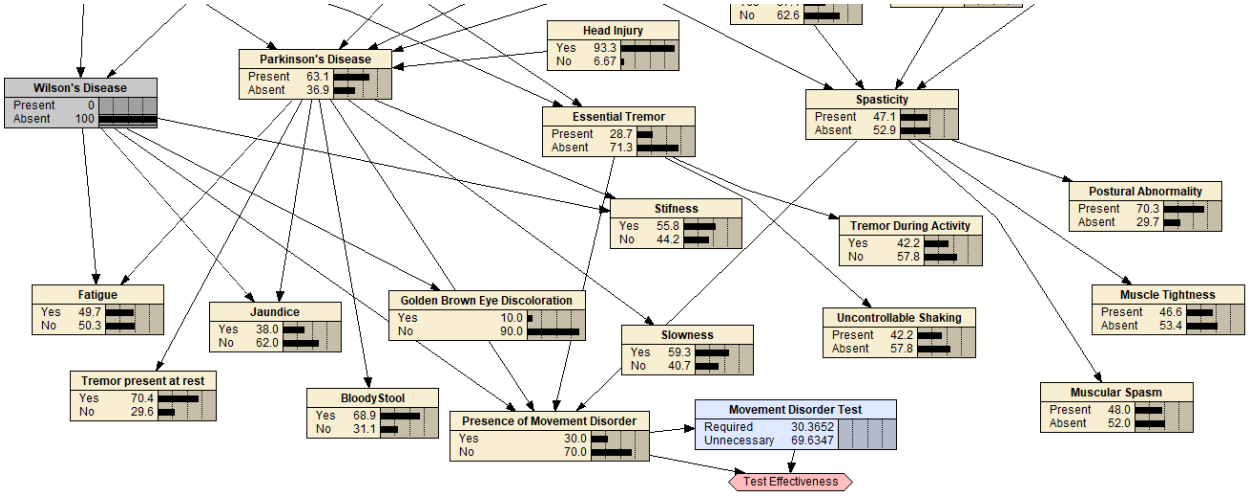
Output samples:

Below are the output samples of the application:

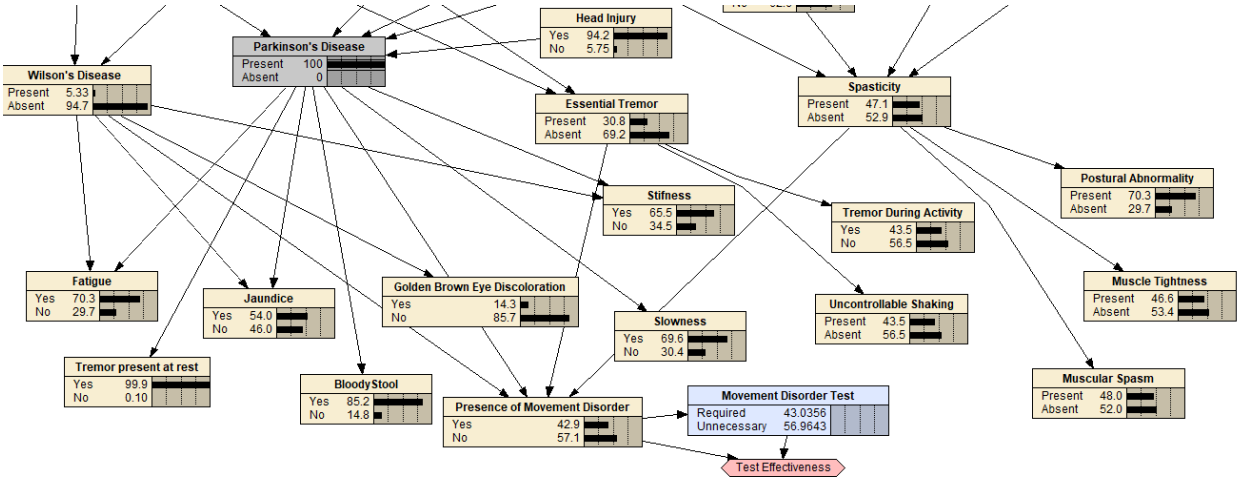
- Image1- The utility of the action Test Required, increases when the present state is chosen in Wilson’s disease node



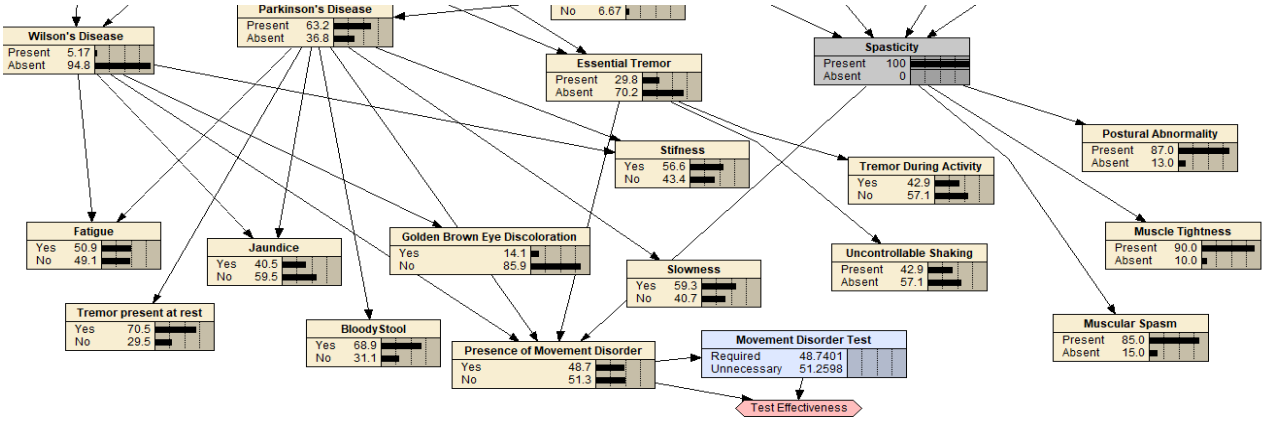
- Image2- The utility of the action Test Required, decreases when the absent state is chosen in Wilson's disease node



- Image3- The utility of the action Test Required increases when the present state of Parkinson's disease is chosen



- Image4—The utility of the action Test Required increases when Present state of Spasticity is chosen.



Conclusion:

Thus, as explained above, this application estimates the utility of the actions Test Required and Test Unnecessary. The utility changes as the states in the nodes chosen by the user changes. This is illustrated in the section **Output Samples**.