CSC 529- SPRING '17

Implementation of a Bayseian Network and Expert System

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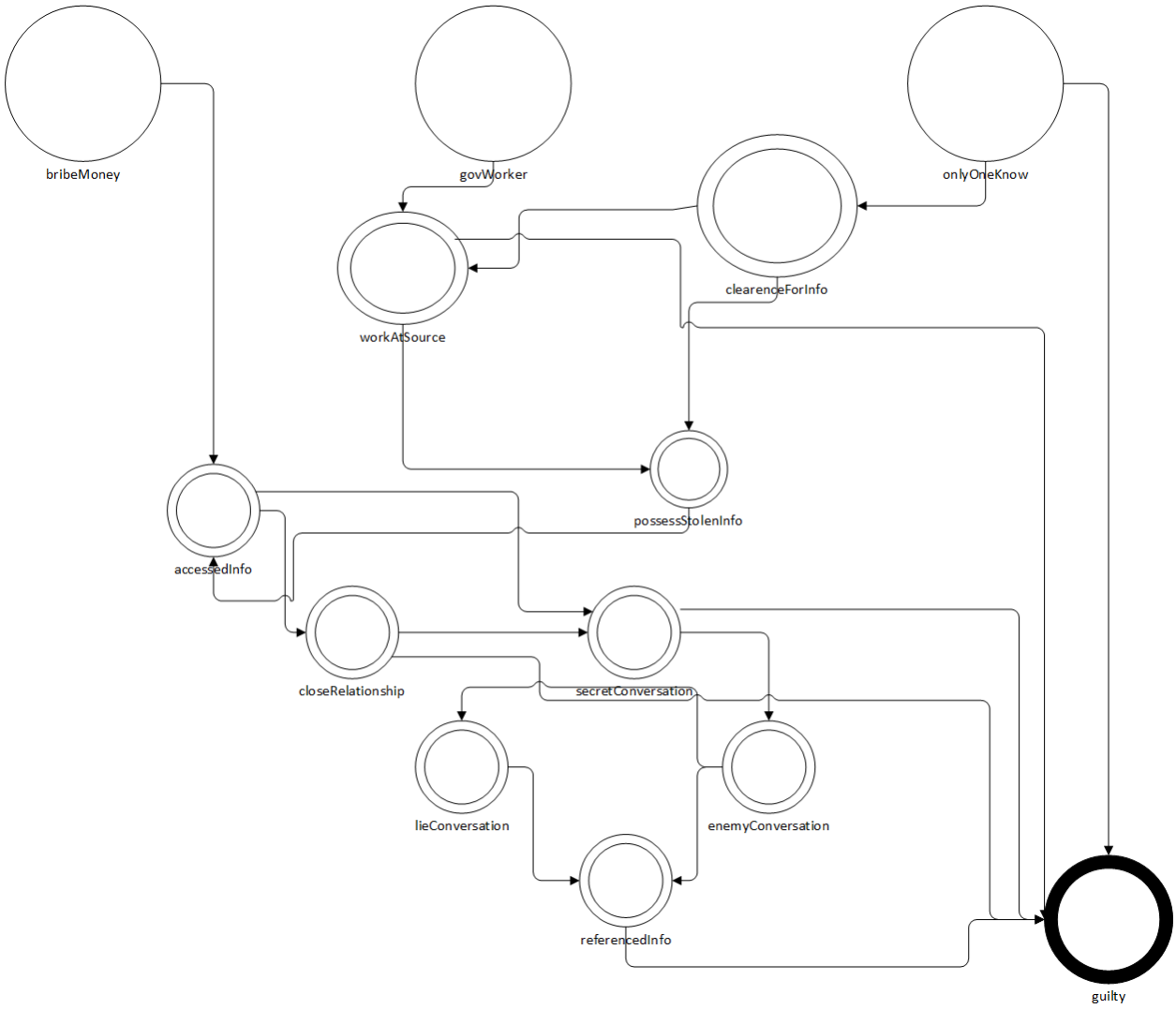
Digital Drawing of Bayseian Network



Variable Names

Variable Computer Name	Variable English Name
accessedInfo	true if suspect was found to have accessed the information
bribeMoney	true if the suspect was found to receive bribes
clearenceForInfo	True suspect had the proper security clearance for the information
closeRelationship	true if the suspect had close ties to someone that did access the information
enemyConversation	true if the suspect had talked with an enemy
govWorker	True if the suspect was a government worker/contractor
guilty	Variable that holds the probability of the suspect being guilty
lieConversation	true if the suspect lied about the conversations in question above
onlyOneKnow	true if suspect was the only person that knew the information
possessStolenInfo	true if suspect was in the possession of the stolen information
referencedInfo	true if the suspect seemed to have referenced the information in the conversations above
secretConversation	true if the suspect had been in secret talks with someone
workAtSource	true if the suspect worked at/for the source of the information

Probability Table

Variable Name	Probability Value
accessedInfo	p(accessedInfo, [bribeMoney], 0.4). p(accessedInfo, [not(bribeMoney)], 0.01).
bribeMoney	p(bribeMoney, ASK). (initial probability)
clearenceForInfo	p(clearenceForInfo, [onlyOneKnow], 0.999). p(clearenceForInfo, [not(onlyOneKnow], 0.85).
closeRelationship	p(closeRelationship, [accessedInfo], 0.1). p(closeRelationship, [not(accessedInfo], 0.74).
enemyConversation	p(enemyConversation, [secretConversation], 0.9). p(enemyConversation, [not(secretConversation)], 0.05).
govWorker	p(govWorker, ASK). (initial probability)
guilty	prob(guilty, [onlyOneKnow], N). prob(guilty, [not(onlyOneKnow), workAtSource, secretConversation, closeRelationship, referencedInfo], N). prob(guilty, [not(onlyOneKnow), not(workAtSource), secretConversation, closeRelationship, referencedInfo], N). prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), closeRelationship, referencedInfo], N). prob(guilty, [not(onlyOneKnow), workAtSource, secretConversation, not(closeRelationship), referencedInfo], N). prob(guilty, [not(onlyOneKnow), workAtSource, secretConversation, closeRelationship, not(referencedInfo), N). prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), closeRelationship, referencedInfo, N). prob(guilty, [not(onlyOneKnow), not(workAtSource), secretConversation, not(closeRelationship), referencedInfo, N). prob(guilty, [not(onlyOneKnow), not(workAtSource), secretConversation, closeRelationship, not(referencedInfo), N). prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), not(closeRelationship), referencedInfo, N). prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), closeRelationship, not(referencedInfo), N). prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), not(closeRelationship), referencedInfo, N). prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), closeRelationship, not(referencedInfo), N). prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), not(closeRelationship), not(referencedInfo), N). prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), not(closeRelationship), not(referencedInfo), N).
lieConversation	p(lieConversation, [enemyConversation], 0.9). p(lieConversation, [not(enemyConversation)], 0.001).
onlyOneKnow	p(onlyOneKnow, ASK). (initial probability).
possessStolenInfo	p(possessStolenInfo, [workAtSource, clearenceForInfo], 0.7). p(possessStolenInfo, [not(workAtSource), clearenceForInfo], 0.2).

	p(possessStolenInfo, [workAtSource, not(clearenceForInfo)], 0.01). p(possessStolenInfo, [not(workAtSource), not(clearenceForInfo)], 0.001).
referencedInfo	p(referencedInfo, [lieConversation, enemyConversation], 0.9). p(referencedInfo, [not(lieConversation), enemyConversation], 0.82). p(referencedInfo, [lieConversation, not(enemyConversation)], 0.85). p(referencedInfo, [not(lieConversation), not(enemyConversation)], 0.4).
secretConversation	p(secretConversation, [closeRelationship, accessedInfo], 0.4). p(secretConversation, [not(closeRelationship), accessedInfo], 0.65). p(secretConversation, [closeRelationship, not(accessedInfo)], 0.35). p(secretConversation, [not(closeRelationship), not(accessedInfo)], 0.25).
workAtSource	p(workAtSource, [govWorker, clearenceForInfo], 0.8). p(workAtSource, [not(govWorker), clearenceForInfo], 0.32). p(workAtSource, [govWorker, not(clearenceForInfo)], 0.2). p(workAtSource, [not(govWorker), not(clearenceForInfo)], 0.01).

Prolog Definition of BN

parent(bribeMoney, accessedInfo).
parent(govWorker, workAtSource).
parent(onlyOneKnow, guilty).
parent(onlyOneKnow, clearenceForInfo).
parent(clearenceForInfo, workAtSource).
parent(clearenceForInfo, possessStolenInfo).
parent(workAtSource, possessStolenInfo).
parent(workAtSource, guilty).
parent(possessStolenInfo, accessedInfo).
parent(accessedInfo, closeRelationship).
parent(accessedInfo, secretConversation).
parent(closeRelationship, secretConversation).
parent(closeRelationship, guilty).
parent(secretConversation, enemyConversation).
parent(secretConversation, guilty).
parent(enemyConversation, referencedInfo).
parent(enemyConversation, lieConversation).
parent(lieConversation, referencedInfo).
parent(referencedInfo, guilty).

Sample Queries

prob(guilty, [onlyOneKnow], N).
prob(guilty, [not(onlyOneKnow), workAtSource, secretConversation, closeRelationship, referencedInfo], N).
prob(guilty, [not(onlyOneKnow), not(workAtSource), secretConversation, closeRelationship, referencedInfo], N).
prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), closeRelationship, referencedInfo], N).
prob(guilty, [not(onlyOneKnow), workAtSource, secretConversation, not(closeRelationship), referencedInfo], N).
prob(guilty, [not(onlyOneKnow), workAtSource, secretConversation, closeRelationship, not(referencedInfo), N).
prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), closeRelationship, referencedInfo, N).
prob(guilty, [not(onlyOneKnow), not(workAtSource), secretConversation, not(closeRelationship), referencedInfo, N).
prob(guilty, [not(onlyOneKnow), not(workAtSource), secretConversation, closeRelationship, not(referencedInfo), N).
prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), not(closeRelationship), referencedInfo, N).
prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), closeRelationship, not(referencedInfo), N).
prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), not(closeRelationship), referencedInfo, N).
prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), closeRelationship, not(referencedInfo), N).
prob(guilty, [not(onlyOneKnow), workAtSource, not(secretConversation), not(closeRelationship), not(referencedInfo), N).
prob(guilty, [not(onlyOneKnow), not(workAtSource), not(secretConversation), not(closeRelationship), not(referencedInfo), N).

Forward Chaining Rules

if military then the_punishment_for_the_suspect_is_death.

if not(military) and criminal and willing and serious then
    the_punishment_for_the_suspect_is_death.

if not(military) and criminal and willing and petty then
    the_punishment_for_the_suspect_is_life_with_possible_parole.

if not(military) and criminal and not(willing) and not(ill) then
    the_punishment_for_the_suspect_is_10000_dollar_fine_and_20_years.

if not(military) and criminal and not(willing) and ill then
    the_punishment_for_the_suspect_is_20_years.

if not(military) and not(criminal) and willing and serious then
the_punishment_for_the_suspect_is_death.

if not(military) and not(criminal) and willing and petty then
the_punishment_for_the_suspect_is_10000_dollar_fine_and_30_years.

if not(military) and not(criminal) and not(willing) and remorse and ill then
the_punishment_for_the_suspect_is_5000_dollar_fine_and_mental_health_help.

if not(military) and not(criminal) and not(willing) and remorse and not(ill) then
the_punishment_for_the_suspect_is_5000_dollar_fine_and_1_year.

if not(military) and not(criminal) and not(willing) and not(remorse) and ill then
the_punishment_for_the_suspect_is_7500_dollar_fine_and_5_years.

if not(military) and not(criminal) and not(willing) and not(remorse) and not(ill) then
the_punishment_for_the_suspect_is_7500_dollar_fine_and_10_years.

FC Variable Definition Table

TERM	EXPLANATION
ask_user	Actually starts calling the program to run.
criminal	Fact asserted if the suspect had a prior criminal activity.
forward	Utilizes the Bratko Forward Chaining interpreter.
guilt	Starts the Forward Chaining Rules by calling ask_user and forward.
ill	Fact asserted if the suspect was mentally ill.
military	Fact asserted if the suspect was active in military.
petty	Fact asserted if the suspect intended to cause minor problems within the United States Armed Forces, such as disloyalty, or insubordination.
remorse	Fact asserted if the suspect showed remorse.
serious	Fact asserted if the suspect intended to cause severe harm towards the United States Armed Forces, and aid its enemies.
willing	Fact asserted if the suspect willingly committed the crime.

Sample Queries on System