NAVAL POSTGRADUATE SCHOOL

"Real" Caller ID Project Update and Demonstration

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Project Review

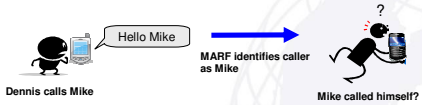
- We would like a means of identifying a caller passively (through normal use).
- Don't want to force users to authenticate in order to place or accept calls
  - Repeated auth is too cumbersome
  - How frequently is auth done?
- Alternative: use what we can observe of calls passively to determine caller identity

Passive Caller ID

- Leverage biometrics (voice) and other context to passively establish caller identity
- Each party still authenticates the other by
  - sound of voice
  - common knowledge
- Passive caller ID is not a substitute for user authentication! (MITM threats exist)

Jan 12 2011 Meeting

- Showed speaker recognition using MARF
- Mixed results using speech alone
- Showed need for exploiting caller context

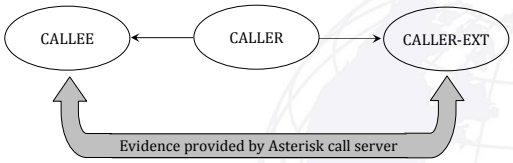


- Focus since has been exploiting context

Approach

- Build a Bayesian network for caller ID
- Treat MARF output as one piece of evidence
- Consider more evidence:
- CALLEE (which number was dialed?)
- CALLER-EXT (which ext placed the call?)
- CALL-TIME (when was call placed?)
- EXT-LOC (where was CALLER-EXT located?)

Naïve Bayes Net



Example

$CALLER = CALLEE = \{2002, 2003, 2004\}$

$CALLER\text{-}EXT = \{1002, 1003, 1004\}$

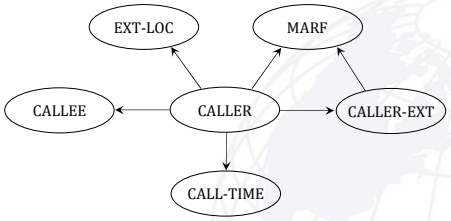
$$P(CALLER = v \mid CALLEE = c, CALLER\text{-}EXT = e)$$

$$= \frac{P(CALLER = v, CALLEE = c, CALLER\text{-}EXT = e)}{P(CALLEE = c, CALLER\text{-}EXT = e)}$$

$$= \frac{P(CALLEE = c \mid CALLER = v)P(CALLER\text{-}EXT = e \mid CALLER = v)P(CALLER = v)}{\sum_{CALLER=2002,\ldots,2004} P(CALLEE = c, CALLER, CALLER\text{-}EXT = e)}$$

$$= \frac{P(CALLEE = c \mid CALLER = v)P(CALLER\text{-}EXT = e \mid CALLER = v)P(CALLER = v)}{\sum_{k=2002,\ldots,2004} P(CALLEE = c \mid CALLER = k)P(CALLER\text{-}EXT = e \mid CALLER = k)P(CALLER = k)}$$

Bayes Net with MARF and LOC



MARF Conditional Probabilities

MARF

Caller Ext	1003		
Caller	2003	2004	2002
2002	0.18	0.14	0.87
2003	0.6	0.17	0.08
2004	0.22	0.69	0.05

Demo Conditional Probabilities

Call_Time

Caller	2003	2004	2002
AM	0.5	0.4	0.2
PM	0.5	0.6	0.8

Callee

Caller	2003	2004	2002
2003	0.01	0.89	0.89
2004	0.495	0.01	0.1
2002	0.495	0.1	0.01

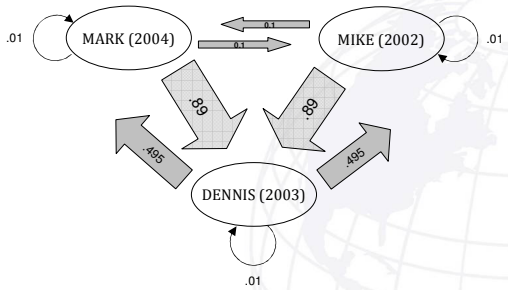
Caller_Ext

Caller	2003	2004	2002
1003	0.9	0.05	0.05
1004	0.05	0.8	0.15
1002	0.05	0.15	0.8

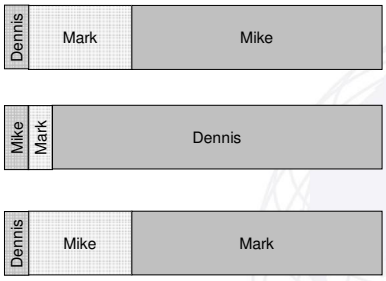
Caller

2003	0.333333
2004	0.333333
2002	0.333333

Demo CALLEE distribution



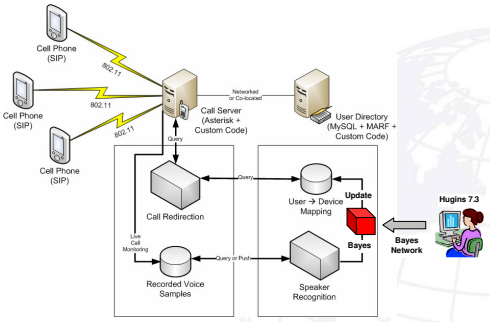
Demo CALLER EXT distribution



Demo

- Updated call server with Bayes net
- Bayes net built using Hugins 7.3
- Hugins produces executable Bayes net
- Bayes net and MARF run after every call
- Before only MARF ran
- MARF output is evidence into Bayes net

New System Architecture



Contacts

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