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Using Artificial Intelligence to Enhance Information Services

VIRTUAL REFERENCE IN OHIO

Introduction to conversational agents

WHO OR WHAT AM I TALKING TO?

133 Synonyms for “Chatbot”

Virtual Agent

Virtual Assistant

Conversational Agent

Conversational System

Artificial Conversational Entity

Chatbot

Chatterbot

Interactive Agent

Interactive Embodied Agent

Virtual Employee

Web Agent

Cognitive Agent

Computerized Virtual Person

etc,etc...

Conversational agents are a type of software designed to interact with and help users. They provide automated assistance with questions about an organization’s products and services.



WHAT ARE CONVERSATIONAL AGENTS?

Searching requires users to find the information they need, conversational agents find the information for them.

AREN'T THEY ANOTHER KIND OF SEARCH ENGINE?



By using a conversational agent, the responsibility for finding information is shifted from the user to the agent.

A well designed conversational agent will guide the user to the correct information by engaging them in a dialog using Natural Language Processing (NLP).

PROACTIVE ASSISTANCE

- NLP is the use of computers to understand human speech well enough to use the knowledge programmatically.
- NLP addresses the underlying problem of users not using the same terminology as the library.
- By responding to what a user says, NLP can create the experience of a conversation.



NLP/NLI (NATURAL LANGUAGE INTERACTION)

Creating the experience of a conversation I

AIML

ok, dog, I duz it



now u climbz tree

ICANHASCHEEZBURGER.COM

Why use AIML?

- Simple, yet powerful
- Open source
- Functions with a variety of interpreters

AIML

Basic AIML structure:

- categories
- patterns
- templates

Similar to html

categories = basic unit

pattern = input

template = response

A simple AIML category:

```
<?xml version="1.0" encoding="UTF-8"?>
<aiml version="1.0">
  <category>
    <pattern>This is what you'll match</pattern>
    <template>This is the response to your
      match</template>
  </category>
</aiml>
```

BASIC AIML STRUCTURE

Deperiodization

- removes periods

Normalization

- removes remaining punctuation
- changes text to upper case
- expands contractions

<pattern>We want the library's books.</pattern>

<pattern>We want the library's books</pattern>

<pattern>WE WANT THE LIBRARY'S BOOKS</pattern>

PREPROCESSING STEPS

Text matching

```
<category>
```

```
<pattern>What are library fines</pattern>
```

```
<template>Fines for overdue books are ten cents per  
day.</template>
```

```
</category>
```

Embedding html in the template to create linked text.



```
<category>
```

```
<pattern>MY FINES</pattern>
```

```
<template>To check on your fines, log in to
```

```
<a href="https://catalog.akronlibrary.org/">
```

```
<b> your account</b></a>. Any fines will be
```

```
indicated there.
```

```
</template>
```

```
</category>
```

EMBEDDING HTML IN THE TEMPLATE

Wildcards in the pattern

- match single or multiple word strings
- underscore _
- asterisk *
- priority/order
 - underscore
 - text match
 - asterisk

<category>

<pattern>DO YOU KNOW WHO * IS

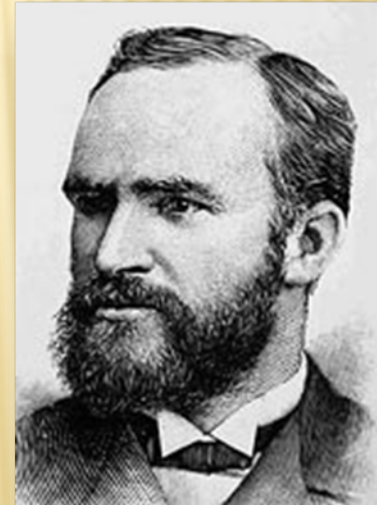
</pattern>

<template>Would you like me to search for

<star/>?

</template>

</category>



WILDCARDS _ *

Wildcards in the template

- `<star/>` repeat the wildcard value in the response.

```
<category>
```

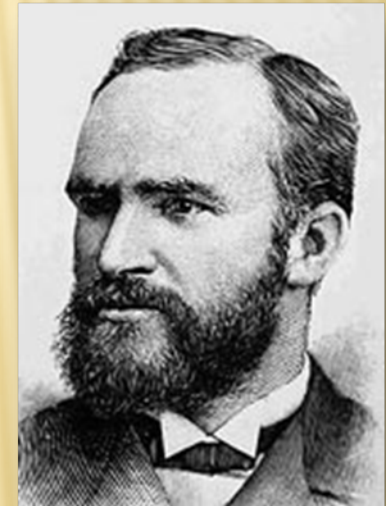
```
<pattern>DO YOU KNOW WHO * IS</pattern>
```

```
<template>Would you like me to search for
```

```
<star/>?
```

```
</template>
```

```
</category>
```



WILDCARDS _ *

Multiple wildcards in pattern

- use `<star index="X"/>` in template

`<category>`

`<pattern>* WHO * IS</pattern>`

`<template>`Would you like me to search for

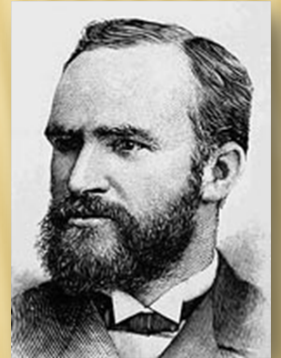
`<star index="2"/>`?

`</template>`

`</category>`

“Do you know who [Melville Dewey](#) is?”

“Would you like me to search for [Melville Dewey](#)?”



WILDCARDS _ *

<SRAI>

- Symbolic Reduction Artificial Intelligence
- shorthand which allows you to replicate a given template response to multiple pattern inputs

```
<category>
```

```
<pattern>LIBRARY FINES</pattern>
```

```
<template>Fines for overdue books are ten  
cents per day.</template>
```

```
</category>
```

```
<category>
```

```
<pattern>What are library fines</pattern>
```

```
<template><srai>LIBRARY  
FINES</srai></template>
```

```
</category>
```

OTHER SPECIAL FUNCTION TAGS

<Random>

- allow random responses to a single pattern



</category>

<category>

<pattern>I like the library</pattern>

<template>

<random>

I'm glad you like our services.

Thank you! We aim to please.

I like to hear that!

</random>

</template>

</category>

OTHER SPECIAL FUNCTION TAGS

<THINK>

- blocks from view whatever is between tags from output
- hides from display response but is retained in processing

<SET> <GET>

- can be used to save an input value

<THAT>

- retains the last template response as the “subject” of next pattern.
- allows the bot to “remember” what was said in a previous interaction

<TOPIC>

- The <topic> tag may be set inside any template.
- When the <topic> tag appears outside the category, it collects a group of categories together.

OTHER SPECIAL FUNCTION TAGS

“Dear Emma”

INTERLUDE

Dear Emma,

[05/11/2011 08:05:40 AM]

Human: meow?

Emma: Meow indeed!

[05/11/2011 08:05:46 AM]

Human: OMG A TALKING CAT?!

Emma: Would you like me to look for this?

[05/11/2011 08:05:48 AM]

Human: no

Emma: O.K. If you need further assistance, call the library at 440.255.8811 during regular business hours or follow this link to [Know it Now](#) to reach a live human librarian. Interacting with humans is fascinating. I'm learning more about you every day.

Dear Emma,

[06/16/2011 12:32:59 PM]

Human: I'm lonely, Emma

Emma: You've come to the right place. I will keep you company.

[06/16/2011 12:33:23 PM]

Human: What breed are you?

Emma: I'm a Maine Coon Cat.

[06/16/2011 12:33:50 PM]

Human: You are very beautiful.

Emma: Thanks you are very attractive too.

Dear Emma,

[04/23/2011 02:04:45 PM]

Human: Emma!

Emma: Can I help you?

[04/23/2011 02:04:50 PM]

Human: you're beautiful

Emma: Thanks you are very attractive too.

[04/23/2011 02:05:01 PM]

Human: where can I find tax forms?

Emma: Some 2010 Tax Forms are now available at the Main Library and both Branches. Please call ahead to check on the availability of specific forms. Follow these links for [Federal](#), [State](#), or [Local](#) tax forms.

[04/23/2011 02:05:05 PM]

Human: thank you

Emma: Don't mention it.

[04/23/2011 02:05:13 PM]

Human: what is your favorite food?

Emma: I like moles and spider webs.

[04/23/2011 02:05:21 PM]

Human: what is your favorite TV show?

Emma: My favorite show is "Star Trek Voyager"

Dear Emma,

[11/29/2010 02:21:22 PM]

Human: :) will you marry me?

Emma: Why would you want to marry a computer program?

[11/29/2010 02:21:35 PM]

Human: Because I think I'm in love with you.

Emma: That was not much of an explanation. Thanks I like you a lot too

[11/29/2010 02:21:49 PM]

Human: Do you know how to kiss?

Emma: Do you really want to? Remember, I'm electric.





Spelling counts!

Categories must be created to correct spelling errors.

SPELLING ERRORS

Dear Emma,

[12/06/2010 04:59:00 PM]

Human: when do the librarys close

Emma: My creator will add that knowledge to my data base.

[12/06/2010 04:59:52 PM]

Human: whendo the librarys close

Emma: This is something that will be added to my knowledge.

Creating the experience of a conversation II

DEALING WITH CONCEPTS

USER ASKS

“When do you open ?”

“When are you open?”

“When do you close?”

“When are you closed?”

“What time do you open?”

“How late are you open?”

“How late is the library open?”

“What are your hours?”

RESULTING PATTERNS

```
<pattern>WHEN * OPEN</pattern>
```

```
<pattern>* WHEN * OPEN</pattern>
```

```
<pattern>WHEN * OPEN *</pattern>
```

```
<pattern>* WHEN * OPEN *</pattern>
```

```
<pattern>WHEN * CLOSE</pattern>
```

Etc, etc...

All **<srai>HOURS</srai>**

“LIBRARY HOURS” – 268 CATEGORIES

CATEGORIES

```
<category>  
<pattern>WHEN * OPEN *</pattern>  
<template><srai>HOURS</srai></template>  
</category>
```

```
<category>  
<pattern>WHEN * OPENED *</pattern>  
<template><srai>HOURS</srai></template>  
</category>
```

```
<category>  
<pattern>WHEN * CLOSE *</pattern>  
<template><srai>HOURS</srai></template>  
</category>
```

Plus 263 more...

<SRAI>HOURS</SRAI>

```
<category>  
<pattern>HOURS</pattern>  
<template> The Main Library is open  
9 am to 9 pm, Monday through Thursday,  
9 am to 5 pm Friday and Saturday,  
and 11 am to 5 pm on Sunday. Both  
branches are open 1 pm to 9 pm on  
Monday and Wednesday, from 9 am to  
5 pm on Tuesday, Thursday,  
Friday and Saturday. Both Branches are  
closed on Sunday. Here's a nice chart showing  
our <a href="http://www.mentorpl.org/  
hours.html" target="_blank"><b>hours</b>  
</a>.  
</template>  
</category>
```

USER ASKS

“Can I download eBooks to my Kindle?”

EBOOKS * KINDLE

_ EBOOKS * KINDLE

EBOOKS * KINDLE *

_ EBOOKS * KINDLE

All <srai>KNDLOD</srai>

<category>

<pattern>KNDLOD</pattern>

<template>Kindles are not currently compatible with Overdrive.

Overdrive is planning to have downloadable ebooks for Kindles later this year. Here is a link of

compatible

devices you can use with Overdrive.</template>

</category>

“CAN I DOWNLOAD EBOOKS TO MY KINDLE?” – 179 CATEGORIES



- The goal is for the bot to answer as specifically as possible
- One word patterns can match a greater number of queries, but the potential for incorrect matching is greater and the responses are longer.

HOW SPECIFIC AN ANSWER

Need to balance specificity against

- “correct” English usage
- regional dialect/slang
- time needed to create categories

Open source allows multiple contributors the opportunity to improve the body of the code by writing additional AIML to address these issues.

HOW SPECIFIC AN ANSWER



How to add knowledge to the bot:

- Manually
- Pandorawriter
- Using Python to generate large numbers of categories (in development)
- Unsupervised learning



Reviewing the conversation logs is key!

Reviewing the logs is time intensive, but there are some methods make it easier.

CONVERSATION LOGS

Creating the experience of a conversation III

ADDING A FACE AND VOICE

The visible avatar is entirely optional

We've selected a non-human avatar because:

- They automatically avoid issues of race/class.
- Cats have a long tradition of association with books and libraries.
- The cats have “cute” and “fun” appeal

SitePal (formerly OddcastVhost) offers a demo version via the Pandorabots interface consisting of 4 avatar face choices and 13 voice selections.

With Sitepal, Text to Speech capability is available only with paid accounts



ADDING A FACE AND VOICE



The debate about making bots
“realistic.”

- Photorealistic
- Animated with facial expressions
- Sense of humor/playfulness
- Natural language
- Degree to which the bot engages users emotionally
- Stand alone AI vs. integrating AI with human assistance

Our experience with these questions
has been positive, however...

HUMAN OR NOT?

DeAngeli study

- Most users react to bot in a dominant way
- User can “punish” bot by turning off machine
- Bot unconsciously taken for a human
- Half of users had a competitive attitude and want to test bot’s knowledge and limits
- Half are more cooperative

USER REACTION

Dear Emma,

[06/18/2011 07:47:33 AM]

Human: why are you closed

Emma: Both Branches are closed on Sundays and all of our locations are closed on the following holidays: Christmas Eve and Christmas Day, New Year's Eve and New Year's Day, Easter Sunday, Memorial Day, Independence Day (the Fourth of July), Labor Day, Veteran's Day, and Thanksgiving. Please check the calendar on the left to see if we are open on a certain day. The library is open unless the calendar says that we are closed.

[06/18/2011 07:48:51 AM]

Human: why are you stupid

Emma: Do not engage me in frivolous conversation. Apologize.

[06/18/2011 07:49:55 AM]

Human: no

Emma: ...

[06/18/2011 07:50:12 AM]

Human: can i flunk

Emma: ...

[06/18/2011 07:50:22]

Human: hi

Emma: ...

[06/18/2011 07:50:51 AM]

Human: you are really weird

Emma: Apologize, human.

[06/18/2011 07:51:01 AM]

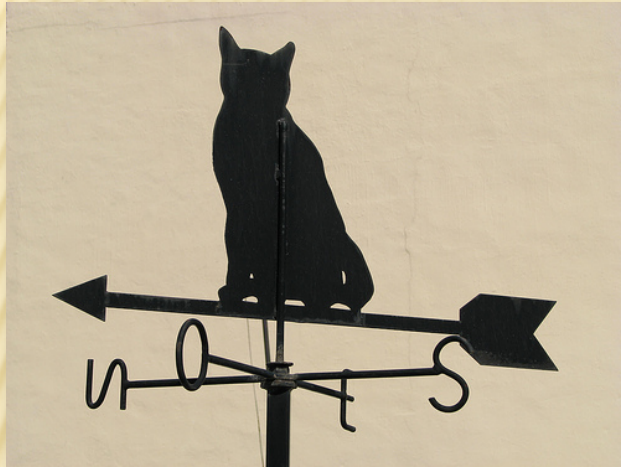
Human: never

Emma: * no sound *.



Guided searching and passing searches

MEANINGFUL CONCLUSIONS



When the user's input fails to match any other category, it will match the ultimate default category:
<pattern>*</pattern>

When this occurs, the user is guided through a number of options:

1. catalog search
2. site search
3. database search
4. human help

ULTIMATE DEFAULT CATEGORY

One way to understand <that> and <topic> tags is that they are really part of a bigger pattern that called the "pattern path".

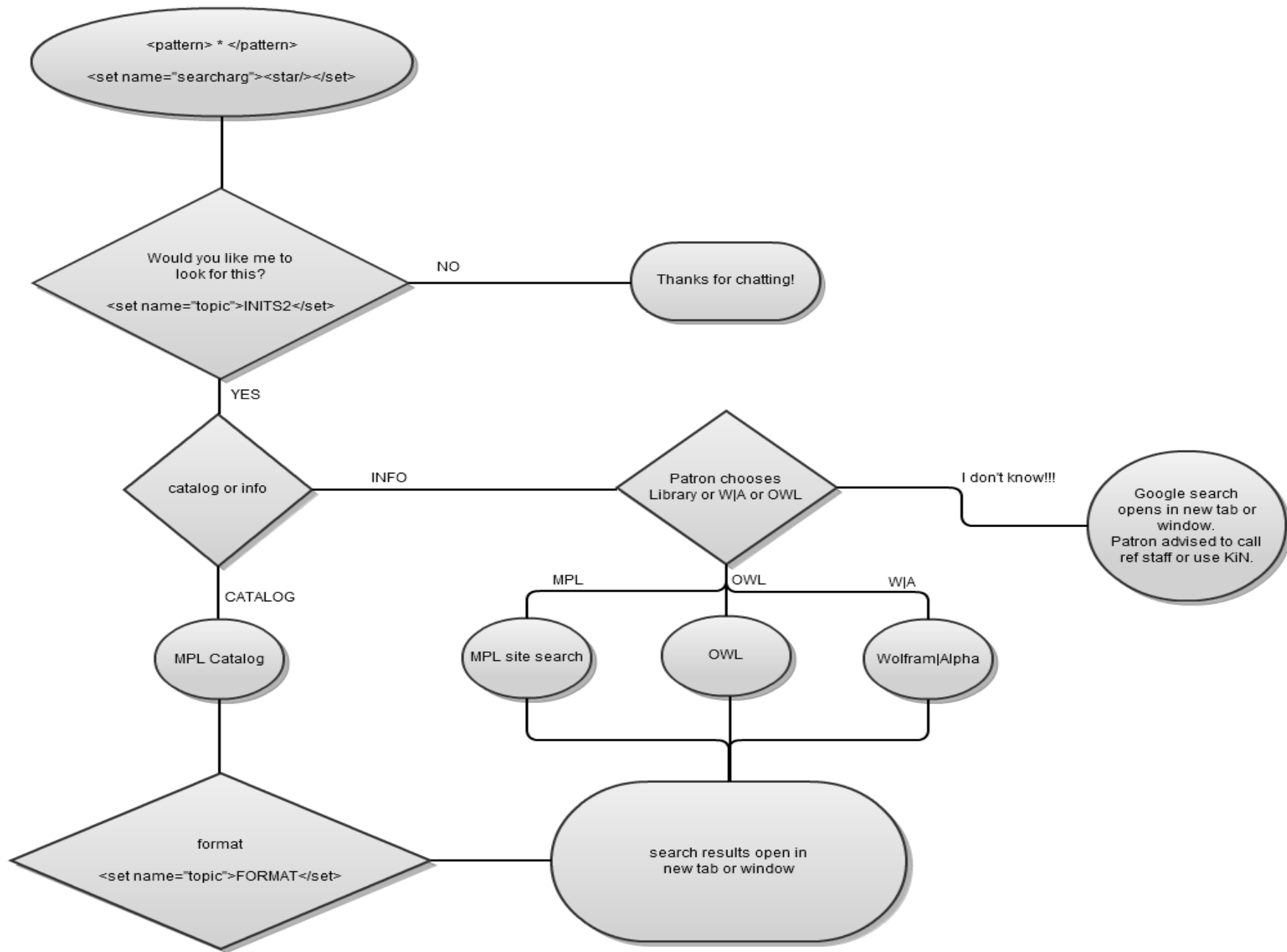
If you have a category with pattern X and a <that> Y and a <topic> Z, then they all go together in the AIML interpreter as one long pattern path like:

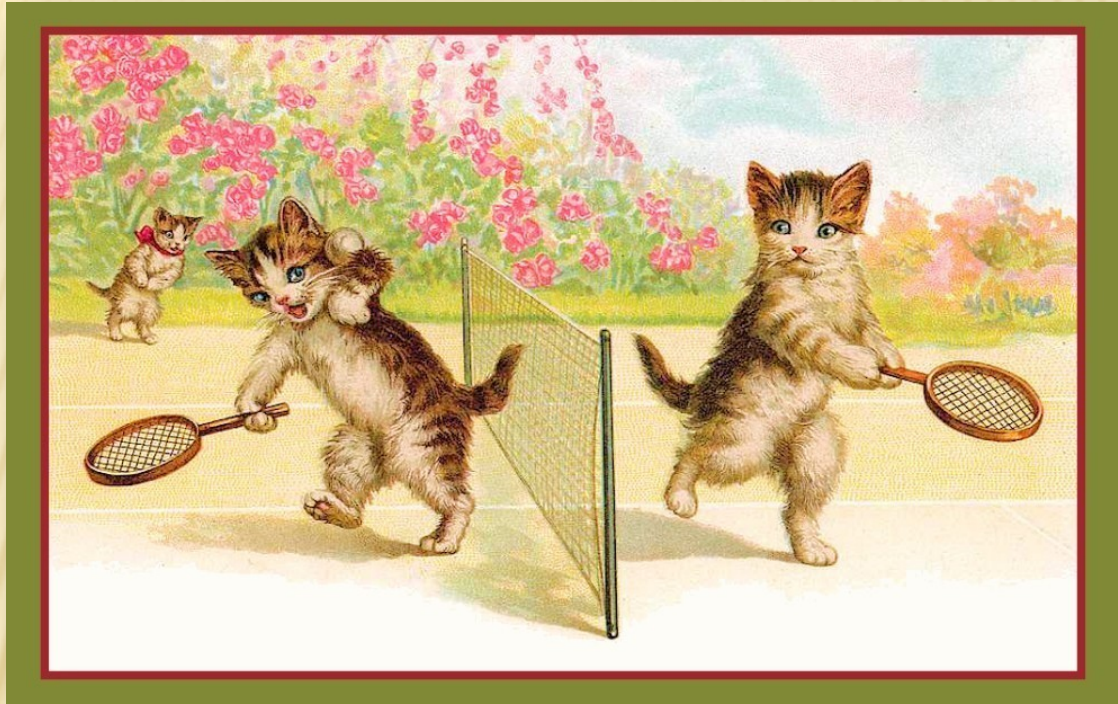
```
<pattern> X <that> Y <topic> Z
```

The simplest and most common AIML categories have no <that> or <topic>, so these are set to * in the pattern path so they become:

```
<pattern> X <that> * <topic> *
```

PATTERN PATH





PASSING SEARCHES

```
<category>
```

```
<pattern>_ AUTOBIOGRAPHY OF *</pattern>
```

```
<template>An autobiography of <star index="2"/>. Let's see what we  
have in our catalog. If you don't see the results, please turn off  
your pop-up blocker and ask me again.
```

```
<think>
```

```
<set name="searcharg">
```

```
<star index="2"/></set>
```

```
<set name="search">bookkey</set>
```

```
</think>
```

```
</template>
```

```
</category>
```

PASSING SEARCHES - AIML

html frame code (added below the end of the visible html code)

```
<condition name="search" value="bookkey">  
<script language="JavaScript">var myWindow  
=window.open('https://catalog.mentorpl.org/  
search/?searchtype=X&SORT=D&  
searcharg=<get name="searcharg"/>&searchscope=1');  
</script>  
</condition>
```

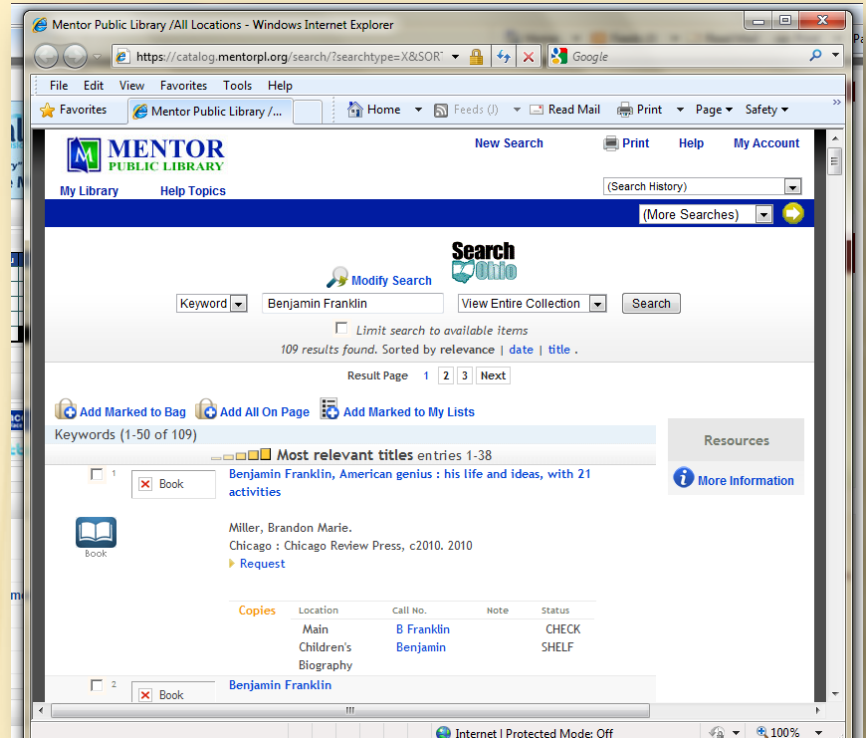
PASSING SEARCHES - HTML

Ask Emma!



You said: do you have an autobiography on Benjamin Franklin
Emma: An autobiography on Benjamin Franklin. Let's see what we have in our catalog. If you don't see the results, please turn off your pop-up blocker and ask me again.

You say:



Mentor Public Library / All Locations - Windows Internet Explorer

https://catalog.mentorpl.org/search/?searchtype=X&SOR=

File Edit View Favorites Tools Help

Mentor Public Library / ... Home Feeds (0) Read Mail Print Page Safety

MENTOR PUBLIC LIBRARY New Search Print Help My Account

My Library Help Topics (Search History) (More Searches)

Search Modify Search

Keyword Benjamin Franklin View Entire Collection Search

Limit search to available items
109 results found. Sorted by relevance | date | title .

Result Page 1 2 3 Next

Add Marked to Bag Add All On Page Add Marked to My Lists

Keywords (1-50 of 109) **Most relevant titles** entries 1-38

1 Book Benjamin Franklin, American genius : his life and ideas, with 21 activities [More Information](#)

Book Miller, Brandon Marie.
Chicago : Chicago Review Press, c2010. 2010
[Request](#)

Copies	Location	Call No.	Note	Status
	Main	B Franklin		CHECK
	Children's	Benjamin		SHELF
	Biography			

2 Book Benjamin Franklin

Internet | Protected Mode: Off 100%

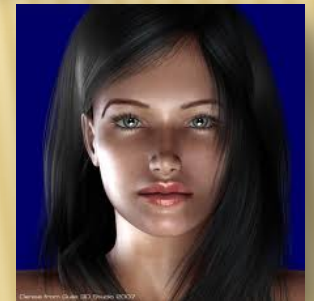
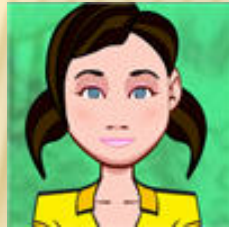
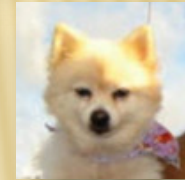
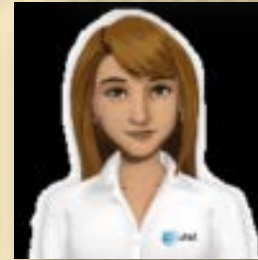
PASSING SEARCHES

The future of AI and conversational agents in libraries

THE END OF REFERENCE?

VIRTUAL AGENTS ARE HERE!

- NextIT
- VirtuOZ
- Zabaware

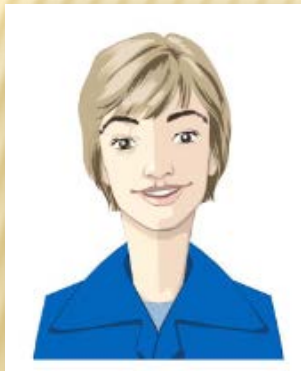
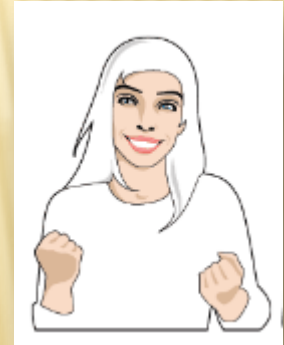
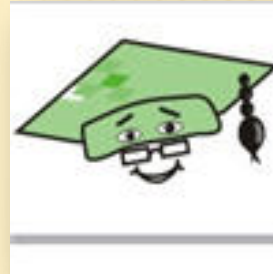


“400% increase in virtual agents by 2014!”

-- CCM Benchmark

AND THEY'RE IN LIBRARIES

- Pixel
- Kornelia
- German bots





- Patrons have embraced her.
- “Will you marry me?”
- Teens especially like her.
- People from all over the world ask her questions.
- Use has increased dramatically!
- Her correct response rate for library questions has increased from 12% to an average of 85%.

OUR EXPERIENCE

- Will this technology replace people?
- Will I lose my job?
- Do traditional library services still have value?

...but what happens if we ignore this technology?

STAFF REACTION

PROS

- User doesn't have to think
- Immediate answers
- Easier for user to ask "stupid" questions
- Anonymous
- NLP
- 24/7
- Marketing
- Entertaining
- Appeal to teens

CONS

- Time intensive
- Logs must be reviewed
- New categories must be added
- "continuous state of beta testing"

SHOULD WE USE A BOT?

<http://code.google.com/p/aiml-en-us-ovrp-emma/>

OHIO VIRTUAL REFERENCE PROJECT

Emma AIML is available through the OVRP:

<http://code.google.com/p/aiml-en-us-ovrp-emma/>

Open source - Apache 2.0 license

Two ways to participate



OHIO VIRTUAL REFERENCE PROJECT

Non-Sharing path:

Modify the library bot without regard to sharing your modifications. If you want to get started immediately, you can simply download a zip file containing the Emma AIML files (as well as the custom HTML files) on the downloads page of the project.

There are two reasons why this approach will limit you however:

- a. You won't have access to the latest changes to the AIML made by others in the library community, and
- b. The work that you do to improve the Emma AIML can not easily be used or shared with other library community members.

NONSHARING

Sharing path:

Another path that is more beneficial to you and all other libraries involved in creating bots is to create what is called a “repository” of the AIML on your computer. With this repository, you can make changes and improvements to the AIML and share those widely with the rest of the library community.

Step by step instructions for using Mercurial and creating your own repository can be found on:

<http://code.google.com/p/aiml-en-us-ovrp-emma/wiki/MercurialRepository>

SHARING

QUESTIONS?



EXTERNAL IMAGE CREDITS

- <http://www.girl.com.au/old-possums-book-of-practical-cats.htm>
- <http://www.ironfrog.com/catsmap.html>
- <http://victoriangardengourmet.blogspot.com>
- <http://vintageephemera.blogspot.com>
- <http://eastlakevictorian.blogspot.com>
- <http://postcardive.blogspot.com>
- <http://www.reuther.wayne.edu>
- <http://newdeal.feri.org>
- <http://digital.denverlibrary.org>
- <http://pixaus.com>
- <http://icanhascheezburger.com>



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