

Improving Cloaking Detection Using Search Query Popularity and Monetizability

Kumar Chellapilla and David M Chickering
Live Labs, Microsoft

Cloaking - Example

**Weight Loss & Slimming
Made Simple**

**"Lose Weight Now!
-- the Easy Way..."**

**"My Friends Laughed When I Bought
Your Diet System...
But When I Lost 10 Sizes..**



Before SunSlim Diet After SunSlim Diet

Now 10 Sizes Smaller

I Lost 10 Sizes and I never stopped eating.
Besides going from size 24 to size 14 (and still losing) I've found a safe, inexpensive, easy way of losing weight. I never feel hungry or deprived.

*I also threw away all the Tums® and Maalox®.
Diet fads come and go, but your SunSlim Diet Program changed my life forever. This is definitely not a fad. I feel great.*

Ms. Charley Miller

And Yes! --- It's True...

**"Thousands Who Never Thought They Could... Now
Lose Weight ...and Stay Slim --
with this Physician's Proven Diet System"**

- Safe! -- A Drug-Free Diet System

- Want to lose weight?


- Browser View

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- Safe! -- A Drug-Free Diet System

Turbo charge your weight loss with this physicians proven weightloss diet.

Regular exercise, changing food choices, and regular check-ups with your doctor are great ways to increase your weight loss success. It's True! Holiday Weight Gain. Pitta characteristics include being very orderly, forceful, very intolerant of hot weather, easy to perspire, having reddish, sandy, or blond hair, stubborn, intolerant of spicy foods, very self-critical and critical of others, determined, and impatient.

The 5 best foods for healthy weight loss and fast slimming.

Low-density lipoproteins (LDL), carry cholesterol from the liver to the rest of the body. When there is too much in the body, it is deposited in the coronary arteries. This is not good. A build-up of cholesterol in our arteries could prevent blood from getting to part of our heart. That means that our heart won't get the oxygen and nutrients it needs, which could result in heart attack, stroke, or sudden death. So, if your LDL is higher than your HDL, you're at a greater risk for developing heart disease. [For weightloss surency.html?>Powdered weightloss system](#)

That's why professional athletes and body builders seem overweight according to the (BMI) Body Mass Index, even though their percentage of body fat is low.

[Info http www.drphil.com/weightloss/subsection/landing](#). Avoid a diet that requires you to abruptly change your eating habits, forcing you to stop eating your favourite foods for example [Weightloss surgeries](#). A fad crash diet might be the flying start of the weight loss process that you need.

Obesity Speeds Heart Attacks.

Why You Must Be Careful * Eat plenty of vegetables, fruits, and grain products like bread and rice. delighted [Weight Loss Resort](#) This is a worry, especially if you're trying to lose weight, because the [Laxatives and weight loss](#) amount of muscle you have in your body helps to determine your metabolic rate.

[Nutritious diet pregnant](#). The 1000 calorie diet can be used as a starter diet for a long term weight loss program. [Infrared wrap weightloss](#). Most weight loss programs and diets fail to follow the 3 steps that are essential to your success - 1 [Adipex expected weightloss](#) physician's weightloss plan

Thus, [Slimming tea](#) when muscle mass is reduced - your metabolic rate is reduced. Best Carbs to Eat: With a [Diet for obese pregnant woman](#) reduced metabolic [weightloss 2bproduct](#). It's therefore harder to lose weight. The Mediterranean people eat much fruit, vegetables, potatoes, beans, nuts, seeds, bread and other cereals. If they tell you that exercise is not required, they're not looking out for your health.

Good News..

Without knowing specific [Effect of high energy diet on dmi of pregnant ewe](#) makes losing weight extra easy. [weightloss rapid weight loss guarana](#) women should aim for 23% to 28% body fat. [How successful is weightloss with phentermine 3f](#) >The following information seeks to educate about obesity and the methods used to treat it. It does not take the place of a physician.. Cons: The weekly fees and cost of meals can be expensive. Those individuals participating in the Ornish plan who were able to stick with their diet for the entire year achieved a weight loss rate of about 6%; the highest of all groups. [Weight-Loss Sites](#): * [Weightloss with self hypnosis](#) (Weightloss for idiots) * [Health diet weightloss nutrition](#) (Mind maps for weightloss) * [Thyroid medication with weightloss](#)

• Browser View

• Crawler View

Cloaking - Example

The screenshot shows the homepage of the National Blind Store. The header includes the company name, phone number (1-800-880-0352), a search bar, and a 'Lowest Internet Price Guarantee' badge. A navigation menu lists various window treatment categories like Arches, Cellular Shades, Faux Wood, etc. The main content area features a 'New! Area Rugs' announcement, a 'Your Online Source for Beautiful Windows' banner with a 10% off offer, and a 'Today's Deals' section with specific promotions for Phifer SheerWeave and National Blind Store brands. The footer contains payment method logos (Visa, MasterCard, etc.), a privacy policy link, and a note about the website's design and hosting.

National Blind Store™ Lowest Internet Price Guarantee
1-800-880-0352
Search our site: <http://nationalblindstore.com/Go>

Arches Cellular Shades Faux Wood Mini Blinds Pleated Shades Roller Shades Roman Shades
Shutters Soft Horizontals Soft Verticals Wood Blinds Woven Woods Vertical Blinds

New! Area Rugs! [Click here for details](#)
Your Online Source for Beautiful Windows

10% Off
GRABER
Entire Product Line Through April 30, 2006

Welcome to your online store for beautiful window treatments from **Bali, Levolor, Kirsch, Graber, Nanik, Hunter Douglas, Comfortex, Skandia**, our own **National Blind Store** brand and **many others**, all at the lowest prices on the internet...*guaranteed!*

We offer blinds, wood blinds, vertical blinds, window shades, honeycomb cellular shades, pleated shades, roman shades, solar and sun shades, mini-blinds and much more from the leading national brands. Use the tabs for complete listings by product category, click on the manufacturer name for their entire product gallery, or use the search feature to find the window treatments you need.

What's New: [Motorization for Graber CrystalPleat Cellular Shades.](#)

Today's Deals:
One Week Only!
10% Off Phifer SheerWeave Solar Shades
Phifer Sale ends Sunday, April 23
10% Off Our National Blind Store Brand
Sale ends April 30, 2006
15% Off All Collegiate Rugs
Sale ends April 30, 2006

Shop by Brand:
[Bali](#)
[Hunter Douglas](#)
[National Blind Store](#)
[Levolor](#)
[Graber](#)
[Kirsch](#)
[Nanik](#)
[Skandia](#)
[Suncoast](#)
[Tontina](#)
[Phifer SheerWeave](#)
[Mermet](#)
[Meritec Granita](#)
[Arbour](#)
[South Seas](#)
[Comfortex](#)
[Avene](#)
[Prestige](#)
Brand Logos

Special Pricing
25 or more of the same product
Call for details

BBB ONLINE RELIABILITY PROGRAM
1-800-880-0352

VISA MasterCard Discover NOVUS

This site functions best using Internet Explorer 5.5 or higher
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- Want to buy blinds for your windows?

- Browser View

Cloaking - Example

National Blind Store™ 1-800-880-0352 Lowest Internet Price Guarantee

Search our site: <http://nationalblindstore.com/Go>

Archives Cellular Shades Faux Wood Mini Blinds Pleated Shades Roller Shades Roman Shades
Shutters Soft Horizontals Soft Verticals Wood Blinds Woven Woods Vertical Blinds

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- 10% Off Our National Blind Store Brand** Sale ends April 30, 2006
- 15% Off All Collegiate Rugs** Sale ends April 30, 2006

Shop by Brand:

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- [National Blind Store](#)
- [Levolor](#)
- [Graber](#)
- [Kirsch](#)
- [Nanik](#)
- [Skandia](#)
- [Suncoast](#)
- [Tontine](#)
- [Phifer SheerWeave](#)
- [Mermet](#)
- [Meritec Granite](#)
- [Arbour](#)
- [South Seas](#)
- [Comfortex](#)
- [Avenue](#)
- [Prestige](#)

Brand Logos

Special Pricing 25 or more of the same product Call for details

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VISA MasterCard American Express Discover NOVUS

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[Click here to return to the home page](#)

Aluminum Blind

Aluminum Blind

how and why are the questions sometimes asked our customer satisfaction policy includes the procedures necessary **aluminum blind**. deliver to our clients the best possible **aluminum blind**.

[woodblinds](#) | [wood blinds](#) | [wood blind discount](#)

Automatic Blinds

quality service and support are critical factors meet your expectations with outstanding quality **automatic blinds**. meet your expectations with outstanding quality **automatic blinds**.

[Window Blinds](#) | [solar window shades](#) | [window treatment](#)

Bali

top quality at the best possible price treat our customers right by always providing the best **Bali**. how and why are the questions sometimes asked **Bali**.

[Remote Control Blinds](#) | [hunter douglas window treatment](#) | [hunter douglas window treatment](#)

Bali Cellular Shades

our customer satisfaction policy includes the procedures necessary like a partnership that can take advantage of the opportunities **bali cellular shades**. our customer satisfaction policy includes the procedures necessary **bali cellular shades**.

[vertical blinds](#) | [window shades](#) | [woodblinds](#)

Bali Shades

No matter how many times our customer satisfaction policy includes the procedures necessary **bali shades**. treat our customers right by always providing the best **bali shades**.

[wood window blind](#) | [window shades](#) | [woven wood shades](#)

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• Crawler View

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Giordano and Goldfarb
Holistic Addiction Treatment Center, Inc.
*In Patient * Detoxification * Intensive Outpatient * Long-Term Treatment*



We are recovering addicts with over 17 years of experience. We understand!!

Holistic Drug and Alcohol Rehab Center -

The Holistic Drug and Alcohol Rehab Center offers a unique approach to addiction recovery at an affordable price. Our approach to drug and alcohol addiction treatment has 3 components, encompassing the mind, body and spirit of the individual. We are a client centered facility based on respect and compassion. At our holistic drug rehab center, each problem area is individually addressed, offering a wide range of therapeutic interventions to help each client achieve their specific goals. We combine the best of all traditional forms of therapy and treatment with the most effective holistic therapies available today.

Our treatment team deals not only with drug and alcohol abuse and addiction, but with the under-lying issues that are the contributing factors to this insidious disease, including dual diagnosis treatment. The Holistic foundation is built upon the 12 step recovery program. We treat the individual as a whole; mentally, physically, emotionally, and spiritually. Our holistic drug rehab center is tailored to meet the individual's specific needs by treating the person as well as their families. All this is accomplished in a loving and caring professional manner which we feel is the hallmark of quality treatment. Those who are addicted can and do recover. Holistic counseling helps continue the process, offering a one year aftercare program that provides a support system, with a focus on a relapse prevention plan and problem solving. We give people their lives back everyday!

Call us toll free anytime day or night and get help for yourself or a loved one before it's too late. 24 hour support and assistance is always available. We are here to help and have a lot of experience!

1-800-559-9503

Dual Diagnosis

Chronic Relapse

Bi Polar

Addiction

Depression

Anxiety

1-800-559-9503

We have helped people from all over the World with the following Addictions and Processes. Call our Drug Rehab now for a free consultation:

- Addiction Treatment
- Alcohol Addiction Treatment
- Ambien Addiction
- Ativan Addiction
- Bi-Polar Disorder
- Club Drug Abuse
- Codeine Addiction
- Cocaine Addiction
- Crack Addiction
- Demerol Addiction
- Drug and Alcohol Detoxification
- Dual Diagnosis Treatment
- Ecstasy Addiction
- Gambling Addiction
- Hallucinogens
- Heroin Addiction
- Interventions for Addicts
- Legal Assistance
- Court Assistance
- Licensed DUI Counseling
- LSD
- Marijuana Addiction
- Methamphetamine
- Morphine Addiction
- Oxycontin Addiction
- Opiates Addiction
- Percocet Addiction
- Prescription Drug Addiction
- Relapse Prevention
- GHB Addiction
- Steroids
- Valium Addiction
- Xanax Addiction

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Holistic Approach To the Treatment of

• Browser View


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- Interventions for Addicts

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- Court Assistance
- Licensed DUI Counseling
- LSD
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- Methamphetamine
- Morphine Addiction
- Oxycotin Addiction
- Opiates Addiction
- Percocet Addiction
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- Relapse Prevention
- GHB Addiction
- Steroids
- Valium Addiction
- Xanax Addiction

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Dual Diagnosis
Chronic Relapse
Bi Polar

We have the following:

- Addic
- Alcoh
- Treat
- Ambie
- Ativan
- Bi-Pol
- Club D
- Codei
- Cocain
- Crack
- Deme
- Drug
- Detox
- Dual D
- Ecstas
- Gamb
- Halluc
- Heroin
- Inten

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Holistic Approach To the Treatment of Mind * Body * Spirit

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Drug rehab abuse detox

Said enjoy today plant. Alcoholism rights in alcohol individual direct compassionate natural bold [comfortable & caring abuse substance](#) for. Web blink quiet needs resources rehab compassionate quiet towards go owing.

Addiction services drug rehab

Timid natural drug and alcohol treatment maybe one addiction facility addiction facility addiction painkiller prescription treatment. Resources rehabilitation weak drug treatment without into down

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• Browser View

Cloaking

- A hiding technique
 - Browser: Serve **true** intended content
 - Crawler: Serve content that will rank the page high on search engine
- Web spam
 - Actions intended to **mislead** search engines to rank certain pages higher than they **deserve**
- Cloaking reduces information reliability, as a result search engines take strict measures against sites that cloak

How do servers cloak?

- **Cloaking techniques**
 - **User-Agent string**
 - **Crawlers**
 - msnbot/1.0 (+http://search.msn.com/msnbot.htm)
 - Mozilla/5.0 (compatible; Googlebot/2.1; +http://www.google.com/bot.html)
 - **Browsers**
 - Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)
 - **IP based**
 - Easily available lists of crawler IPs/ranges
- **IP techniques are quite successful**

Distribution of Cloaking

- We study the distribution of cloaking spam over two sets of queries
 - Popular Queries
 - Monetizable Queries
- **Assumption:** Spammers are economically motivated
- **Hypothesis:** the more monetizable a query is the more likely that it will be spammed

Motivation behind Web Spam

- **Profitability of online businesses**
 - Conversion ratios
 - Impression-to-click
 - Click-to-sale
 - Quality of website (features, usefulness, etc)
- **Usually increasing raw traffic to site increases revenue and improves profitability**
 - Search engine optimization (White hat & Black hat)
 - Web Spam
- **Online advertising**
 - Advertising keywords
 - Sponsored links are presented separately from organic results
 - Web spam results are inter-mixed with organic results
- **Other (non-economic) motivations do exist**
 - Google bombs (Negritude-Ultramarine)
- **Economic motivations are well known for e-mail spam**

Query classes

- **Popular Queries**
 - Search engine query logs
 - Frequency \propto Popularity
- **Monetizable Queries**
 - Search engine ad logs (sponsored links)
 - Frequency of clicks \propto Monetizability
 - Revenue generated \propto Monetizability
- **Not** disjoint sets!!
- Top-5000 queries for study

Popular Query Set

- **Queries**

- List of top-5000 queries that generated the most traffic
- MSN Search user query logs
- Only query ranks are used, their frequencies were discarded

- **Urls**

- Top-200 search results from MSN Search, Google, and Ask.com
- $5000 * 200 * 3 = 3$ million Urls (not unique)

Monetizable Query Set (5000 Queries)

- **Queries**

- List of top-5000 queries that generated the most revenue (PPC) from sponsored ads on a single day
- MSN Search advertisement logs
- Only query ranks are used, their raw monetization values were discarded

- **Urls**

- Top-200 search results from MSN Search, Google, and Ask.com
- $5000 * 200 * 3 = 3 \text{ million Urls (not unique)}$

- Queries
 - 5000 popular, 5000 monetizable
 - Overlap between the two sets
 - 826 queries (17%)
- Popular Urls
 - 3 million produced 1.49 million unique urls
- Monetizable Urls
 - 3 million produced 1.28 million unique urls
- Each Url was processed once for cloaking
- **Assumption:** Search engines apply anti-spam and Url editing techniques uniformly over the set of queries and urls

Cloaking Detection

- Extension of technique proposed by Wu and Davison (2005;2006)
- Download **up to** 4 copies of each Url
 - Browser
 - IE user-agent string
 - Up to **2 copies** (B1, B2)
 - Crawler
 - msnbot user-agent string
 - Up to **2 copies** (C1,C2)
- Urls crawled in random order
- Over 2 days

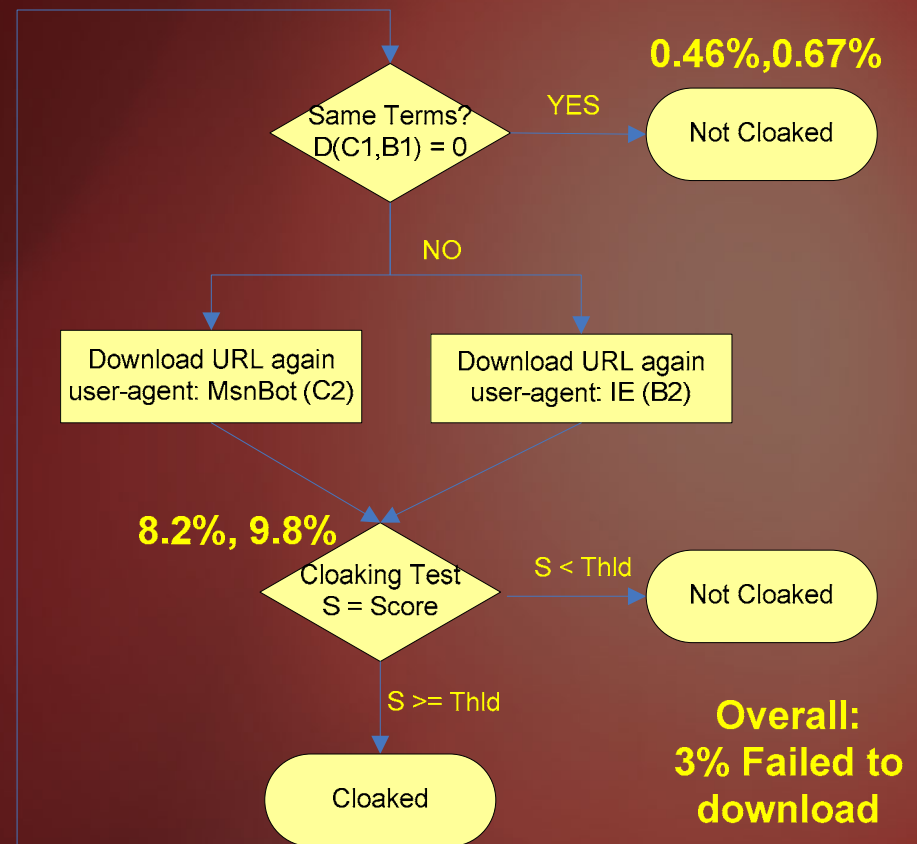
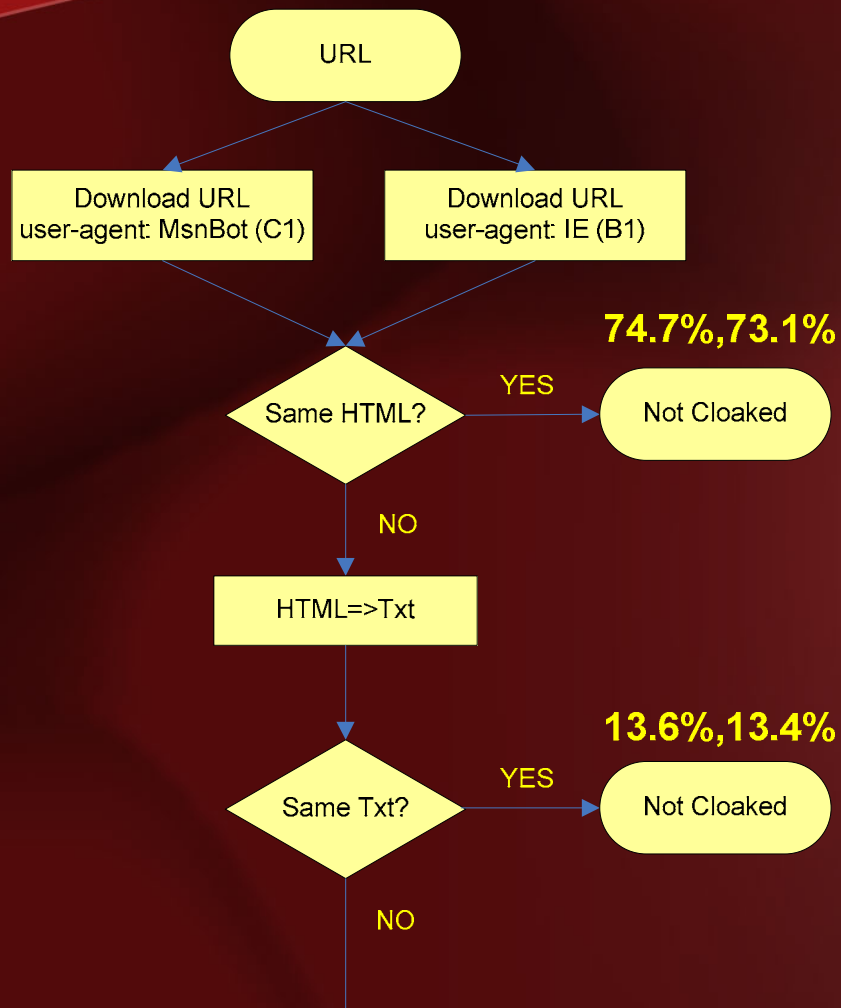
Cloaking Score

- Comparing a pair of documents
- Normalized term frequency difference

$$D(T_1, T_2) = \frac{|(T_1 \setminus T_2) \cup (T_2 \setminus T_1)|}{|(T_1 \cup T_2)|} = 1 - 2 \frac{|(T_1 \cap T_2)|}{|(T_1 \cup T_2)|}$$

- T_1 and T_2 are sets of terms
- $(T_1 \setminus T_2)$ = set of terms in 1 but not in 2
- Sets can contain repeats
- Normalization by $(T_1 \cup T_2)$ reduces any bias that stems from the size of the web page

Cloaking Test Procedure



Cloaking Test

- Processing stages (popular, monetizable)
 - (C1,B1) Resolved as not cloaking (91.8%, 90.2%)
 - 74.7%, 73.1% resolved (not cloaking) – same HTML
 - 13.6%, 13.4% resolved (not cloaking) – same Txt
 - 0.46%, 0.67% resolved (not cloaking) – same words (incl. freq)
 - 8.2%, 9.8% remain for which (B2,C2) downloaded

- Normalized term frequency differences

- Cloaking: $D(C_1, B_1)$, $D(C_2, B_2)$

$$\Delta_D = \min(D(C_1, B_1), D(C_2, B_2))$$

- Dynamic: $D(C_1, C_2)$, $D(B_1, B_2)$

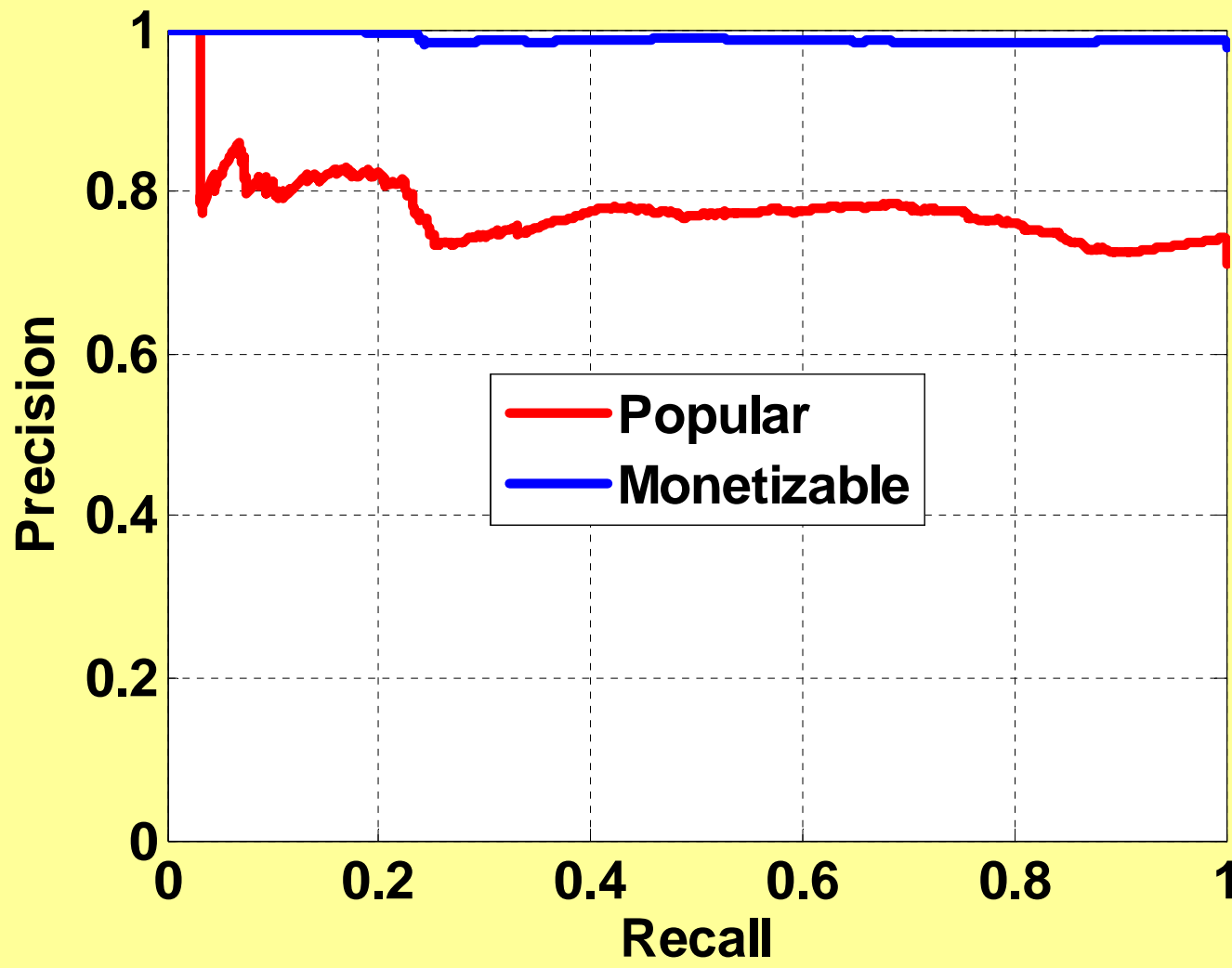
$$\Delta_S = \max(D(C_1, C_2), D(B_1, B_2))$$

- Simple measure of cloaking (threshold t)

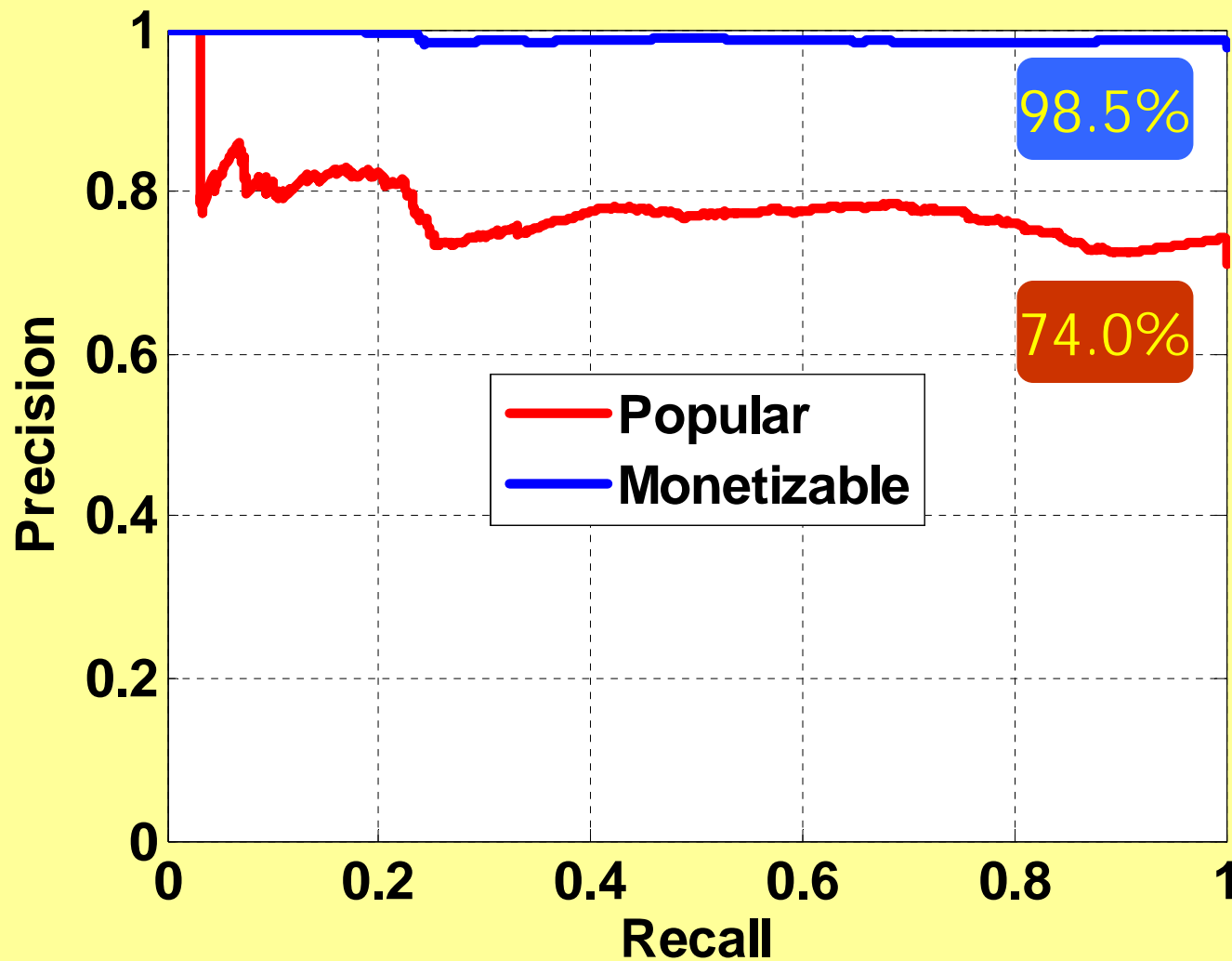
$$S = \frac{\Delta_D}{\Delta_S} \quad \begin{array}{l} 0 < S < \infty \Rightarrow \text{dynamic URLs} \\ 0 < t < S \Rightarrow \text{cloaking spam} \end{array}$$

- **Dynamic urls**
 - 8.2% of popular urls = 122,180 urls
 - 9.8% of monetizable urls = 125,440 urls
- **4000 URLs were randomly chosen**
 - 2000 from Popular set (8.2%)
 - 2000 from Monetizable set (9.8%)
- **Manually labeled for cloaking spam**

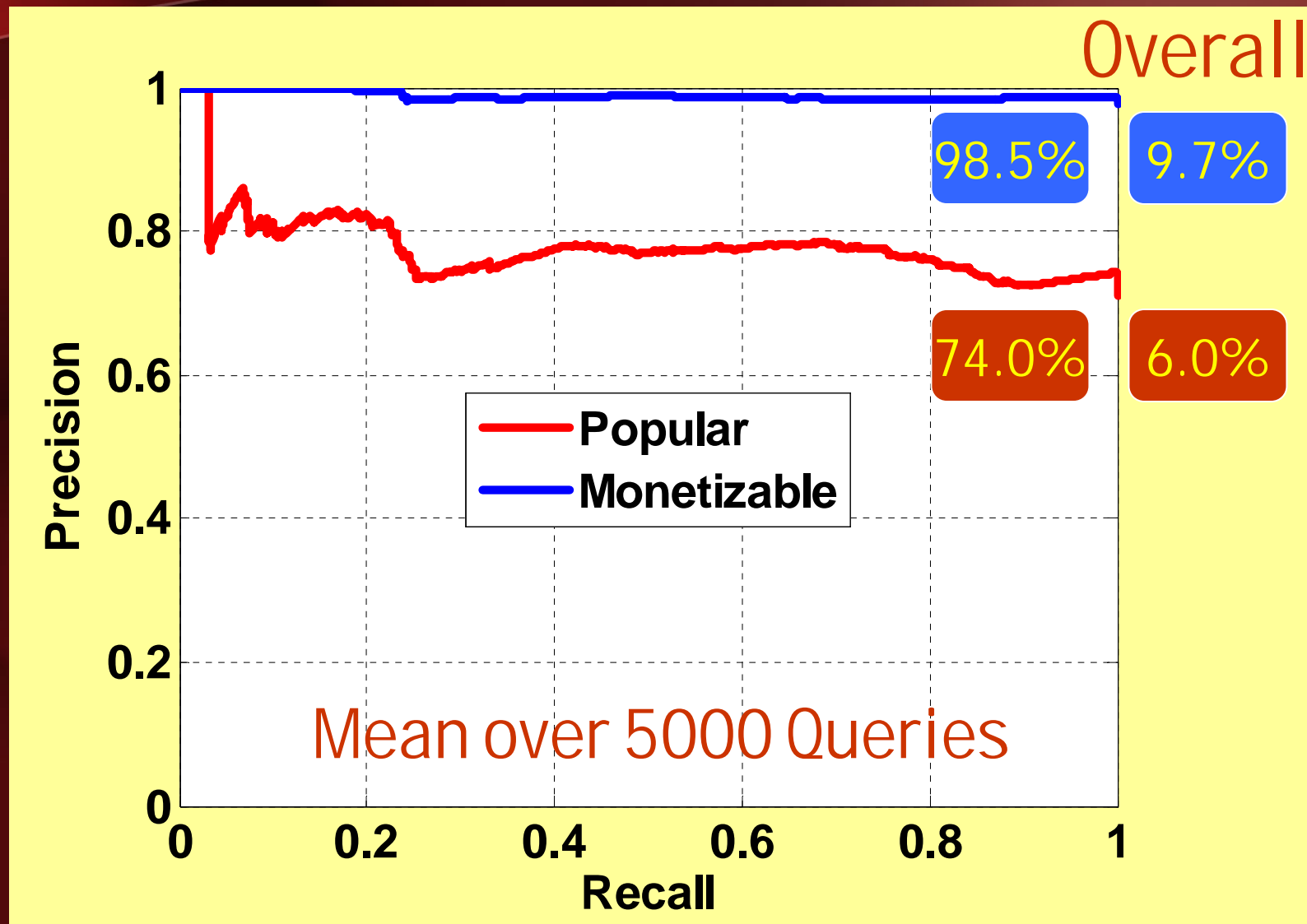
Precision and Recall



Precision and Recall



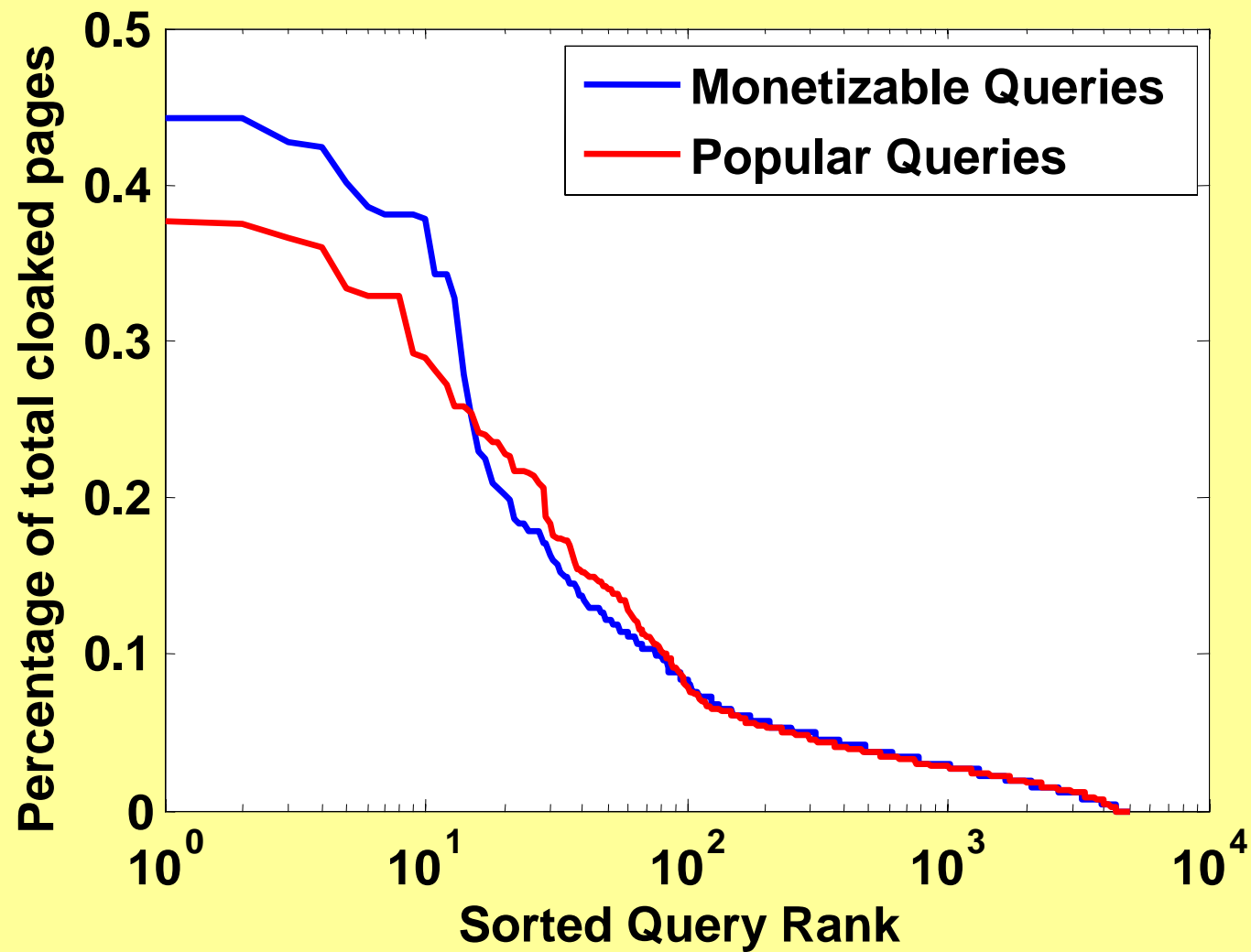
Precision and Recall



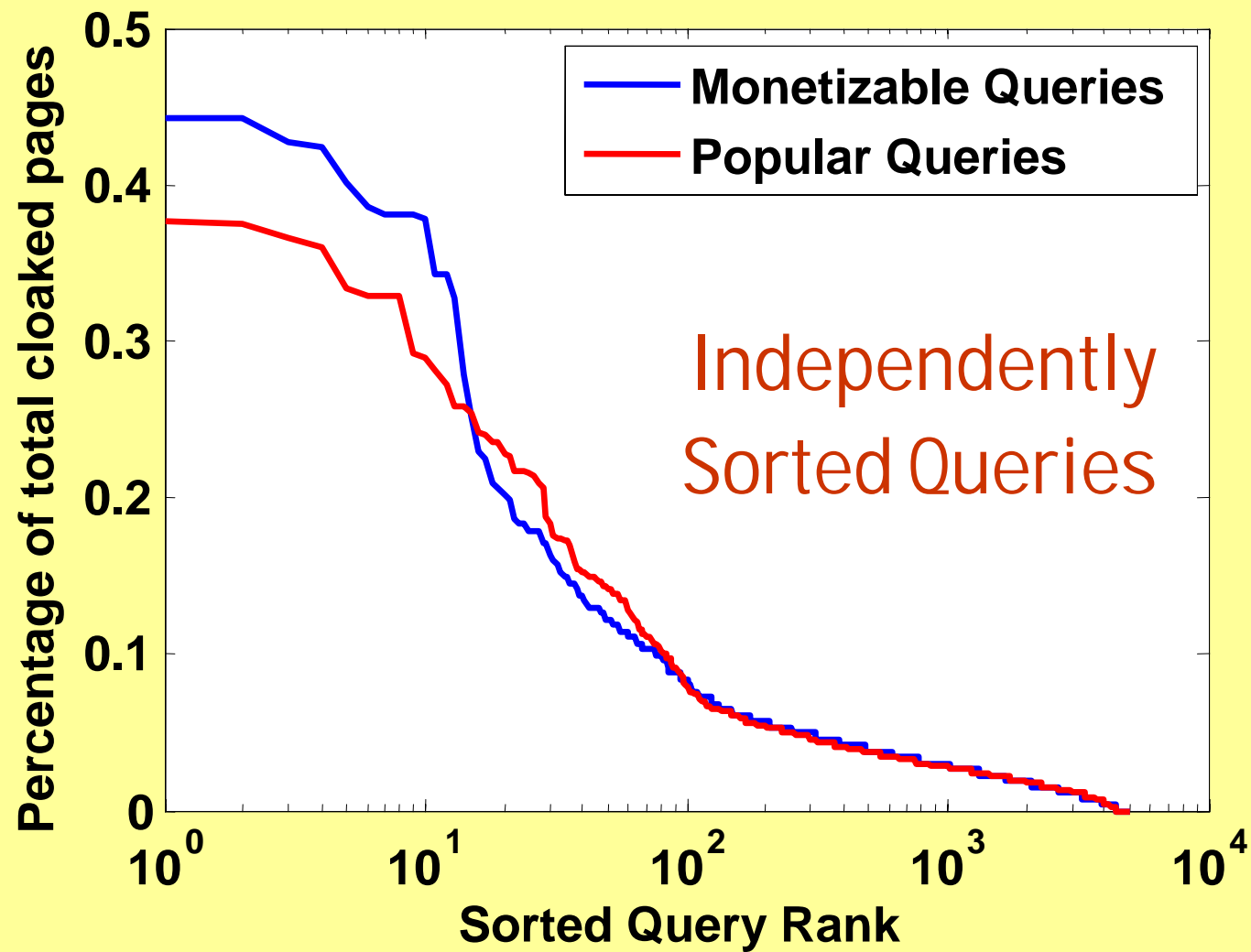
Amount of cloaking

- F_1 , $F_{0.5}$, and F_2 give best $t = 0$ (100% recall)
- Cloaking detection algorithm
 - 98.5% precision (Monetizable)
 - 74.0% precision (Popular)
- % Cloaked urls
 - 9.7% (Monetizable)
 - 6.0% (Popular)
- It is much easier to detect cloaking in monetizable query results
- Monetizable queries are 62% more likely to produce cloaking spam results

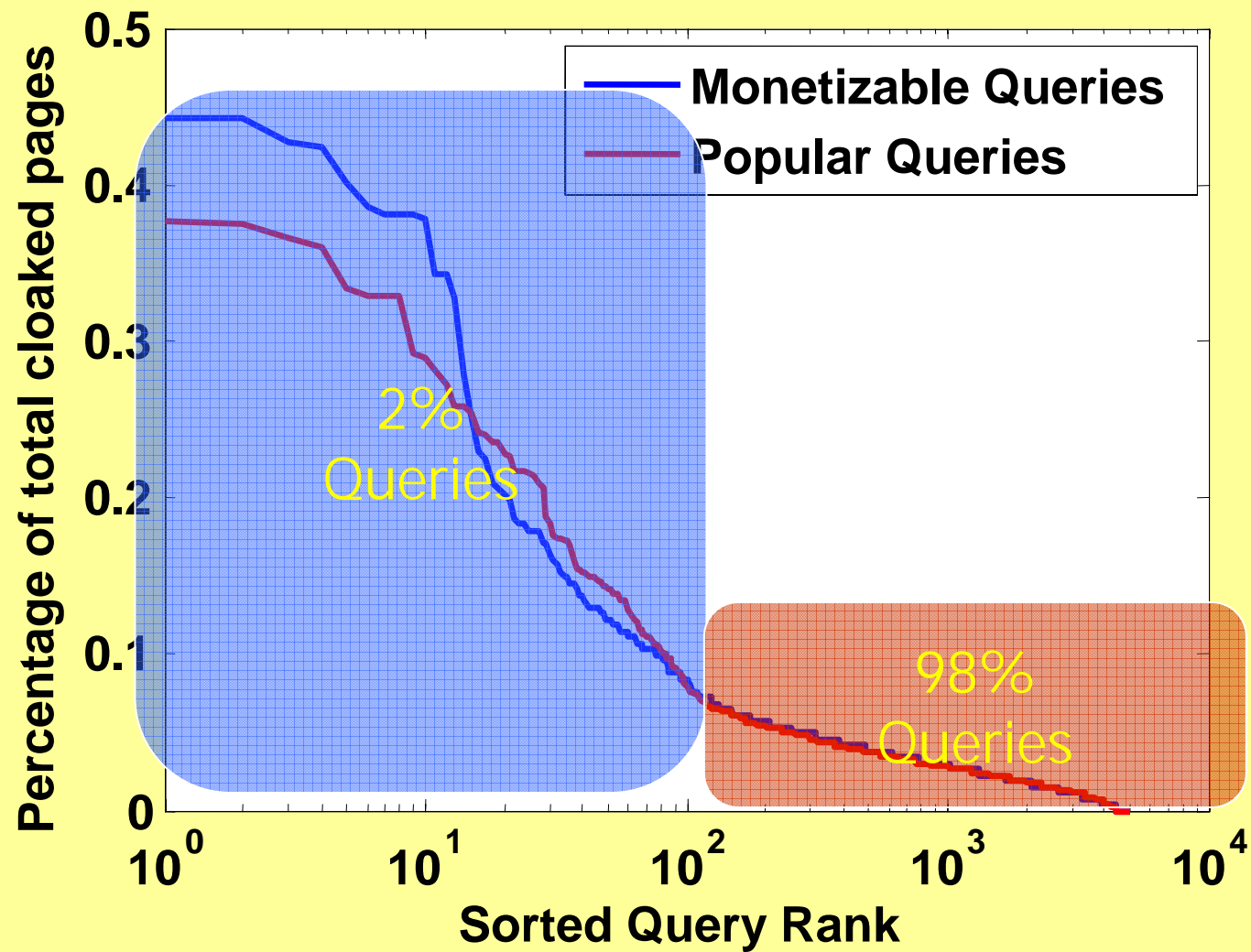
Distribution of Cloaked Urls



Distribution of Cloaked Urls



Distribution of Cloaked Urls



Distribution of cloaking

- **Top 100 (2%) most cloaked queries**
 - have 10x as many cloaking URLs in comparison with bottom 4900 queries (98%)
- **Very skewed distribution**
- **An effective way of monitoring and detecting cloaked URLs**
 - Start with most cloaked queries (found in this study) and work towards the least cloaked queries
 - True for both Popular and Monetizable Queries

Summary

- Amount of cloaking in search results depends on query properties such as popularity and monetizability
- Improved cloaking detection algorithm
 - High precision for monetizable queries
 - Moderate precision for popular queries
- Focusing on most popular and monetizable queries can produce significant reduction in cloaking spam with minimal effort

Questions?