Exploring and Understanding Social Media

Liangjie Hong

Dept. of Computer Science & Engineering
Lehigh University

November 6, 2009
Outline

1. What is Social Media
2. Question Answering in Social Media
3. Enhancing Web Search with Social Media
So, before 2.0 ...
So, before 2.0 ...

- Static web pages
So, before 2.0 ...

- Static web pages
- Minimum user interactions
So, before 2.0 ...

- Static web pages
- Minimum user interactions
- Information creators vs. Information consumers
So, before 2.0 ...

- Static web pages
- Minimum user interactions
- Information creators vs. Information consumers
- Just an extension of libraries?
What is Social Media

We are still in Web 1.0
What is Social Media

We are still in Web 1.0

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Social Media
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What is Social Media

We are still in Web 1.0

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What is Social Media

We are still in Web 1.0

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What is Social Media

We are still in Web 1.0 😃
A Typical Search Engine for Web 1.0
A Typical Search Engine for Web 1.0

- Full-text indexing
A Typical Search Engine for Web 1.0

- Full-text indexing
- Query $\rightarrow$ Term Weighting + Link Analysis
A Typical Search Engine for Web 1.0

- Full-text indexing
- Query $\rightarrow$ Term Weighting $+$ Link Analysis
- Ranked results
Social Media

Static Web → Dynamic Web

Mailing lists
• Discussion Boards, Forums
• Wikipedia, Question Answering Portals
• MySpace, Facebook, Linkedin
• Social Bookmarking
• Twitter
What is Social Media

Static Web $\rightarrow$ Dynamic Web

- Mailing lists

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Static Web → Dynamic Web

- Mailing lists
- Discussion Boards, Forums
Static Web → Dynamic Web

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- Discussion Boards, Forums
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Static Web → Dynamic Web

- Mailing lists
- Discussion Boards, Forums
- Wikipedia, Question Answering Portals
- MySpace, Facebook, Linkedin
- Social Bookmarking
- Twitter
- ...

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So What?

• Changed the way search engine works?
• Changed users' expectation?
• Changed business
• Changed marketing

...
So What?

- Changed the way search engine works?
So What?

- Changed the way search engine works?
- Changed users’ expectation?
So What?

• Changed the way search engine works?
• Changed users’ expectation?

• Changed business
• Changed marketing
• ...

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The Challenges
The Challenges

- Document boundary
The Challenges

- Document boundary
- Independent assumption? → Information Networks!
The Challenges

- Document boundary
- Independent assumption? → Information Networks!
- Presentation
The Challenges

- Document boundary
- Independent assumption? → Information Networks!
- Presentation
- Natural language queries
The Challenges

- Document boundary
- Independent assumption? → Information Networks!
- Presentation
- Natural language queries
- Need answers!
The Challenges

• Document boundary
• Independent assumption? \(ightarrow\) Information Networks!
• Presentation

• Natural language queries
• Need answers!
• Need to communicate
• ...

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1 What is Social Media

2 Question Answering in Social Media

3 Enhancing Web Search with Social Media
How do we find answers on the Web?
How do we find answers on the Web?
9 Fix For Firefox 3 Crashes & Hanging Problem
Firefox 3 is one of Best Open Source Browser and highly Secure Browser. With the Release of Firefox 3 on Download Day it has made the way to millions of ...
www.blogsdna.com/.../9-fix-for-firefox-3-crashes-hanging-problem.htm
Cached - Similar - ☯ ☯ ☯

My Temporary Solution to Fix Mozilla Firefox 3 Random Crashing ...
Jun 27, 2008 ... And sometimes Firefox 3 crash is caused by ModName unknown at offset 0521001d. ... My Firefox 3 always crashes when logging into Gmail. ...
www.raymond.cc/.../my-temporary-solution-to-fix-mozilla-firefox-3-random-crashing-problem/
Cached - Similar - ☯ ☯ ☯

firefox 3 crashes, won't start
21 posts - 15 authors - Last post: Jun 18, 2008
I removed my personal settings, uninstalled all Google software and reinstalled firefox 3. It still doesn't work. I get the Crash Reporter ...
support.mozilla.com/tiki-view_forum_thread.php?... - Cached - Similar - ☯ ☯ ☯

Firefox 3.0.7 crashes all the time! - Mar 17, 2009
Firefox 3.0 crashes but does not trigger the Breakpad crash report ... - Jun 30, 2008
Firefox 3.0 crashes on startup after install - Jun 29, 2008
More results from support.mozilla.com »

Firefox 3.0 CRASHES - Computer Forums
10 posts - 5 authors - Last post: Jun 30, 2008
Ever since I downloaded the latest 3.0 version, the only thing this browser is doing is to crash continually. Was curious if anyone else ...
www.tech.forums.net/pc/50/firefox-3.0-crashes-178475/ - Cached - Similar - ☯ ☯ ☯

More results from support.mozilla.com »
Answers to Common Questions

How to Setup SSH?

“Ok, i can log in fine now following that guide, though all that i did was use the AUTH .pkk file before trying, which you have to do EVERYtime. Is there a way to i just enter username and password? Also, am i allowed to use a tunnel with...


See entire page »

Can anyone please inform me on how to setup ssh to not allow remo...?

“Thats the best way to get your thread closed by a Moderator who is me in fact that doesn't appreciate you breaking our rules by letting things get personal by you making personal attacks upon me. Keep it up and you'll lose all privileges t...

https://www.linuxquestions.org/questions/showthread.ph...

See entire page »

Will Netbeans' Subversion feature ever have an ssh login setup li...?

“I want to use Netbeans but my subversion repository uses SSH and I don't want to make a private key. I want to use a username and password like I do for Eclipse's Subclipse plugin. Will Netbeans' Subversion Setup eventually let you use a ...

http://getsatisfaction.com/netbeans/topics/will_netbea...

See entire page »

More Common Questions

- Does SSH allow you to setup a dedicated server?

- What is the difference between the Netbeans subversion with SSH?
Two Sources

- Discussion Boards, Forums
- Question Answering Portals (Community Question Answering)
Two Sources

- Discussion Boards, Forums
- Question Answering Portals (Community Question Answering)
Two Sources

- Discussion Boards, Forums
- Question Answering Portals (Community Question Answering)
Question Answering on Discussion Boards
Question Answering on Discussion Boards

Difficult?
Difficult?

- Mixed content: comments, news, tutorials, personal experiences
Question Answering on Discussion Boards

Difficult?

- Mixed content: comments, news, tutorials, personal experiences
- Quality: no punctuation, spell errors ...
What is a question / answer? (document boundary problem!)
What is a question / answer? (document boundary problem!)

- a sentence
- a paragraph
- several paragraphs
- a post
- ...
Question Answering on Discussion Boards

What is a question / answer? (document boundary problem!)

- a sentence
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What is a question / answer? (document boundary problem!)

- a sentence
- a paragraph
- several paragraphs
- a post
- ...

Simplified version: One question $\rightarrow$ One answer
Question Answering on Discussion Boards

Two sub-tasks

• Question detection
• Answer detection

a classification problem

simple features (combination) vs. NLP
Question Answering on Discussion Boards

Two sub-tasks

- Question detection
- Answer detection
Two sub-tasks

- Question detection
- Answer detection

- a classification problem
- simple features (combination) vs. NLP
Question Answering on Discussion Boards

For Questions

- Question mark (1 feature)
- 5W1H words (6)
  why, what, where, which, when, how
- Thread length (1)
  total number of posts
- Authorship (1)
  #first post/#total posts
- N-gram (1000-3000)
For Questions

- Question mark (1 feature)
- 5W1H words (6)
  - why, what, where, which, when, how
- Thread length (1)
  - total number of posts
- Authorship (1)
  - #first post/#total posts
- N-gram (1000-3000)
Question Answering on Discussion Boards

For Answers

- Post position (2)
- Authorship (1)
- N-gram (1000-3000)
- Stopwords (571)
- Query Likelihood Model (Language Model) (1)
Question Answering on Discussion Boards

For Answers

- Post position (2)
- Authorship (1)
- N-gram (1000-3000)
- Stopwords (571)
- Query Likelihood Model (Language Model) (1)
Datasets

- PhotographyOnTheNet (http://www.photography-on-the.net/)  
  721, 442 threads  
- UbuntuForums (http://www.ubuntuforums.org)  
  555, 954 threads

- Sampled approximately 500 threads for each sub-task and dataset
Classification Methods

- Manually labeled questions vs. non-questions
  one best answer per thread
- 10-fold cross validation
- libSVM for classification
- Measured performance by Precision, Recall, F-Measure, Accuracy
Comparisons to existing methods

- **For questions**
  Part-Of-Speech tagging + Sequential Pattern Mining

- **For answers**
  Graph-based model incorporated with inter-posts relevance, authorship and similarity
Question Answering on Discussion Boards

Question Detection

Single Feature on UbuntuForums

<table>
<thead>
<tr>
<th>Feature</th>
<th>F-Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>QM</td>
<td>0.641</td>
</tr>
<tr>
<td>5W1H</td>
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<td>Length</td>
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<td>Author</td>
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<td>SPM</td>
<td>0.754</td>
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<tr>
<td>N-gram</td>
<td>0.833</td>
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Question Answering in Social Media

Question Answering on Discussion Boards

Question Detection

Single Feature on PhotographyOnNet
Question Answering on Discussion Boards

Question Detection

Combined Features on UbuntuForums

<table>
<thead>
<tr>
<th>Feature</th>
<th>F-Measure</th>
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</thead>
<tbody>
<tr>
<td>A+LEN</td>
<td>0.716</td>
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<tr>
<td>Q+5+LEN</td>
<td>0.722</td>
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<tr>
<td>A+Q+5+LEN</td>
<td>0.746</td>
</tr>
<tr>
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Question Answering on Discussion Boards

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Combined Features on PhotographyOnNet

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<tr>
<td>SPM</td>
<td>0.671</td>
</tr>
<tr>
<td>Q+5+LEN</td>
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<tr>
<td>N-gram</td>
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</tr>
<tr>
<td>A+Len</td>
<td>0.843</td>
</tr>
<tr>
<td>A+Q+5+Len</td>
<td>0.876</td>
</tr>
</tbody>
</table>
Question Answering on Discussion Boards
Answer Detection

Single Feature on UbuntuForums

F-Measure

- GQL: 0.620
- Stop: 0.640
- NG: 0.663
- LM: 0.682
- POSI: 0.737
- AUTH: 0.765
Question Answering on Discussion Boards
Answer Detection

Single Feature on PhotographyOnNet

GQL: 0.591  
LM: 0.659  
NG: 0.706  
Stop: 0.712  
AUTH: 0.735  
POSI: 0.827

F-Measure
Question Answering on Discussion Boards
Answer Detection

Combined Features on UbuntuForums

F-Measure

<table>
<thead>
<tr>
<th>Feature组合</th>
<th>F-Measure</th>
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</thead>
<tbody>
<tr>
<td>Stop+NG</td>
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</tr>
<tr>
<td>LM+Stop</td>
<td>0.761</td>
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<tr>
<td>LM+POSI</td>
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<td>LM+A</td>
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<tr>
<td>POSI+Stop</td>
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<td>LM+POSI+A</td>
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</tr>
<tr>
<td>POSI+A</td>
<td>0.952</td>
</tr>
</tbody>
</table>
Question Answering on Discussion Boards

Answer Detection

Combined Features on PhotographyOnNet

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Social Media

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Summary

- Question Detection
  N-gram
  Authorship + Question Mark + 5W1H + Length

- Answer Detection
  Position, Authorship
  Position + Authorship
  Language Model + Position + Authorship
Two Sources

- Discussion Boards, Forums
- Question Answering Portals (Community Question Answering)
Two Sources

- Discussion Boards, Forums
- Question Answering Portals (Community Question Answering)
Search Results for "why the sky is blue"

Blue Sky Drugs

Blue Sky
www.Target.com - Blue Sky Online. Free Shipping on 100,000+ Products.

Why is ocean water and the sky blue?
... and goes into the blue sky does it come back down with the color... The blue color of the sky is due to Rayleigh... everywhere overhead, the sky looks blue. As you look...
Asked by Big foot - 3 years ago - Earth Sciences & Geology - 25 Answers - Resolved Questions

why do my sky blue t-shirts become tie-dye out of the wash?
Whenever I wash my sky-blue t-shirts they always end up looking like tie... well. never wash reds with blues. colors with whites. use...
Asked by jar - 3 years ago - Cleaning & Laundry - 4 Answers - Resolved Questions

Please help me on the famous question why is the sky blue?
So, the sky is blue because blue color from... another question about the blue color. The reason the... s just that the wavelengths in the blue range are scattered more than...
Asked by Rec - 2 years ago - Physics - 8 Answers - Resolved Questions

Why is the sky blue, the grass green, and my hair brown?
Why is sky light blue, the grass dark green, and my hair dark brown? ... 1. Because of
Question Answering on CQA

Problems

• same or similar questions
• different category
• different time

• Read them all?
• Trust them all?
Question Answering on CQA

- content
- user reputation
Question Answering on CQA

- content
- user reputation
Question Answering on CQA

HITS-like Scheme

User

User

User

User

User

Questioner

Answerer
Question Answering on CQA

HITS-like Scheme

questioner - hub
answerer - authority
PageRank-like Scheme

- User
- User
- User
- User
Question Answering on CQA

PageRank-like Scheme

Diagram showing user interactions.
Incorporating topics

- Combine content for users
- Unsupervised topic model (Probabilistic Latent Semantic Analysis)
- Topical PageRank
Incorporating topics

- Combine content for users
- Unsupervised topic model (Probabilistic Latent Semantic Analysis)
- Topical PageRank
Other heuristics

- \( Z = \frac{a-n/2}{\sqrt{n/2}} = \frac{a-q}{\sqrt{a+q}} \)

- \( SimpleRank = \theta \ast a + (1 - \theta) \ast q \)
Question Answering on CQA

Dataset

- Yahoo Answers!
  14,122 questions + 45,814 answers
  12,731 users
- Strict & Relaxed
  Precision@1, MRR, Precision@10, MAP
- BM25 + User Reputation
Question Answering on CQA

Evaluation

<table>
<thead>
<tr>
<th>P@1(S)</th>
<th>MRR</th>
<th>P@1(R)</th>
<th>P@10</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0857</td>
<td>0.1414</td>
<td>0.3410</td>
<td>0.3170</td>
<td>0.3081</td>
</tr>
</tbody>
</table>

![Graph showing evaluation metrics for different algorithms: PageRank, Topical PageRank, SimpleRank, HITS.](image)
Evaluation

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- PageRank
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- **PageRank**
- **Topical PageRank**
- **SimpleRank**
- **HITS**
Summary

- user reputation helps retrieval
- but may not help question answering
1. What is Social Media

2. Question Answering in Social Media

3. Enhancing Web Search with Social Media
Integrating Search Results with Twitter

- When
- How
- What
Integrating Search Results with Twitter: When

\[ P(S = s | Q, T) = \frac{P(Q, T | S = s)P(S = s)}{P(Q, T)} \]
Integrating Search Results with Twitter: When

Assumption 1: \( P(Q, T | S = s) = P(Q | T, S = s)P(T | S = s) \)

Assumption 2: \( P(Q, T) = P(Q)P(T) \)

\[
P(S = s | Q, T) \propto \frac{P(Q | T, S = s)P(S = s | T)}{P(Q)}
\]
Integrating Search Results with Twitter: How

Document Boundary Problem!

- “Virtual Document”, an extension of inverted index
- “cat” → 10, 23
- “cat” → “dog”, “food”, ...
Integrating Search Results with Twitter: What

Presentation Problem!

- “Tag Cloud”
- “Top Messages”
Enhancing Web Search with Social Media

Dataset

- 300 queries from Google Insights
- MSN query log
- 29,762,170 individual messages and 2,349,723 distinct terms
## When to integrate

<table>
<thead>
<tr>
<th></th>
<th>Top 10</th>
<th>Bottom 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>iddaa</td>
<td>Rising 1 (Sports)</td>
<td>tv</td>
</tr>
<tr>
<td>mynet</td>
<td>Rising 4 (Internet)</td>
<td>real</td>
</tr>
<tr>
<td>emlak</td>
<td>Rising 3 (Real Estate)</td>
<td>free</td>
</tr>
<tr>
<td>kariyer</td>
<td>Rising 3 (Business)</td>
<td>us</td>
</tr>
<tr>
<td>milliyet</td>
<td>Rising 3 (News)</td>
<td>blog</td>
</tr>
<tr>
<td>myvideo</td>
<td>Rising 4 (Photo Video)</td>
<td>video</td>
</tr>
<tr>
<td>bitesize</td>
<td>Rising 6 (Science)</td>
<td>love</td>
</tr>
<tr>
<td>miniclip</td>
<td>Rising 8 (Game)</td>
<td>se</td>
</tr>
<tr>
<td>mappy</td>
<td>Rising 5 (Reference)</td>
<td>as</td>
</tr>
<tr>
<td>meb</td>
<td>Rising 4 (Society)</td>
<td>you tube</td>
</tr>
</tbody>
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When to integrate
What to present

<table>
<thead>
<tr>
<th>Query</th>
<th>Methods</th>
<th>Tag Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>cake</td>
<td>Topic Model Retrieval Model</td>
<td>eat eating cheese white tea pizza w bar apple yummy sugarery evaarrs heavenscarrot mayyyyy bannanana desset boop spelnidid</td>
</tr>
<tr>
<td>google</td>
<td>Topic Model Retrieval Model</td>
<td>twitter via blog tv facebook web iphone internet video de appenginge lookskindawierd billenkoek twotiny fillhoo fluidapp</td>
</tr>
<tr>
<td>education</td>
<td>Topic Model Retrieval Model</td>
<td>public state power law american world daily president united america parentale iguides #edu estroke animalsays sombiz tewksbury globalhighered</td>
</tr>
<tr>
<td>boat</td>
<td>Topic Model Retrieval Model</td>
<td>looking state heavy cross happy square office garden board lake nmma politicising maxum tuffin sevylor boatshoes lawrencetown</td>
</tr>
<tr>
<td>honda</td>
<td>Topic Model Retrieval Model</td>
<td>motor ford audi posted mini toyota sport cars vw diesel warungmobil ayutthya #honda gresini sohc dohc honda catback crosstour crx</td>
</tr>
</tbody>
</table>
## What to present

<table>
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<th>Query</th>
<th>Methods</th>
<th>Tag Cloud</th>
</tr>
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<tbody>
<tr>
<td>cake</td>
<td>Topic Model Retrieval Model</td>
<td>#wine #ff #followfriday #recipe #sports #music #money #mac #gfree #food #baking #hw #mustfollow #chocolate #sales #recipe #fun</td>
</tr>
<tr>
<td>google</td>
<td>Topic Model Retrieval Model</td>
<td>#twitter #followfriday #internet #google #facebook #myspace #wikipedia #marketing #groovy #latitude #tweefind #gps #horticulture #downloads #googlereader</td>
</tr>
<tr>
<td>education</td>
<td>Topic Model Retrieval Model</td>
<td>#tweetmyjobs #followfriday #marketing #job #tcot #jobs #twitter #freedom #edu #scholarship #massteacher #daleyforum #jobmatcha #advice #dc #zimbabwe</td>
</tr>
<tr>
<td>boat</td>
<td>Topic Model Retrieval Model</td>
<td>#followfriday #job #photography #tweetmyjobs #music #ff #sgp #art #camera #san #sailing #dhl #finalfour #gadgets #tech #news #fb</td>
</tr>
<tr>
<td>honda</td>
<td>Topic Model Retrieval Model</td>
<td>#vw #golf #followfriday #tweetmyjobs #thinkofnick #ebay #firefox #bmwland #honda #bumpers #decals #mazda #car #oregon #toyota #automotive</td>
</tr>
</tbody>
</table>
Sample “Top Twitter Messages” for Query “bikes”

Community Discovery Top

#Nelson #eBay bikes http://bit.ly/fjOUI

@Rebecca_black Okay. The bikes are in the back. You can use @Accident_Prones bike. Don't for get the helmet.

Leave it to kristen we were getting the bikes from the car she manages to hit me in the face with the handle and give me a swollen eye#fb

http://tinyurl.com/lq9qnmYBP - Bikes

using the bikes and the skateboard as cross training for the up-coming ski season.

Community Discovery Bottom

@dPain119 makesa my dreams come true

What a fabulous Saturday this has been! It’s great to be out and see so many bikes and hot rods!!

oh it sunday , that means my lap top go off all night as it gone off 6 times in last 10 mins, and bikes will be speeding on bye pass

Decided to give my kids bikes away so they wont try to ride them on my 2 story roof!

Looks like a beautiful day. Coffee: check! Bikes and all gear: check! Heading to N. Shore for a day up above Dillingham. Long climb: Master!

Retrieval Model

@ohjp bikes bikes bikes

#Nelson #eBay bikes http://bit.ly/fjOUI

http://tinyurl.com/lq9qnmYBP - Bikes

Bikes http://yfrog.com/67pu9sj

Enhancing Web Search with Social Media

See more Tweets about bikes

Top links shared in Tweets about bikes

On My Way To EICMA 2009 from Bikes in the Fast Lane - Daily Motorcycle... news.motorbiker.org/blogs.nsf/dx/on-my-way-to-eicma-2009.htm

LowriderLenny: On My Way To EICMA 2009 from Bikes in the Fast Lane - Daily ... http://bit.ly/1X3muS (motorbiker.org) · 2 hours ago

wanderingdoggy: On My Way To EICMA 2009 from Bikes in the Fast Lane - Daily ... http://bit.ly/3n21V0 (motorbiker.org) · 2 hours ago

See more Tweets about news.motorbiker.org/blogs.nsf/dx/on-my-way-to-eicma-2009.htm

BBC Watchdog talks bikes 18 Bikes

18bikes.co.uk/news.php?articleshow=362

18bikes: BBC watchdog check sub £100 bikes. Surprisingly, they're shite. http://bit.ly/2y6Wgh (18bikes.co.uk) · 5 hours ago

philjevons: Great watching. RT: @18bikes : BBC watchdog check sub £100 bikes. Surprisingly, they're shite. http://bit.ly/2y6Wgh (18bikes.co.uk) · 5 hours ago

See more Tweets about 18bikes.co.uk/news.php?articleshow=362
Social Media

- interesting
- challenging
- emerging research area
Social Media

- interesting
- challenging
- emerging research area

Thank you!