

Knowledge Graphs for innovation

15 Oct. 2021

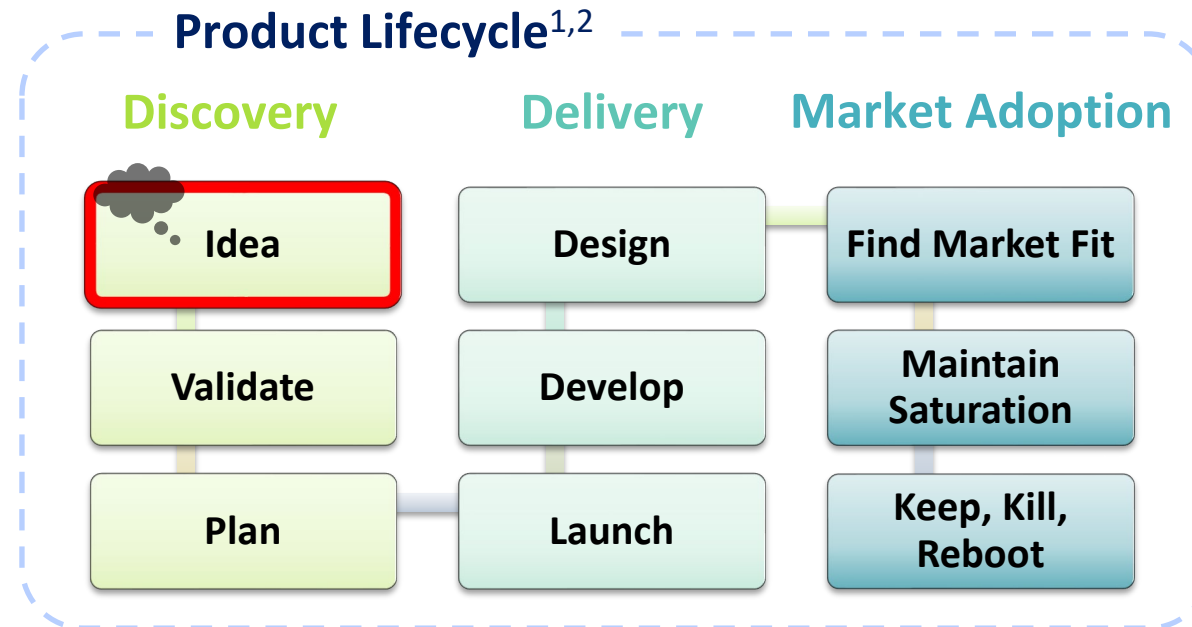
Dawa Chang



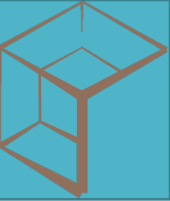


The potential of Knowledge Graphs

- to help enhancing creativity & mitigate uncertainty
- in idea generation/selection phase
- to be developed as a tool (application)



1. Levitt, T. (1965). Exploit the product life cycle (Vol. 43). Graduate School of Business Administration, Harvard University.
2. Day, G. S. (1981). The product life cycle: analysis and applications issues. Journal of marketing, 45(4), 60-67.

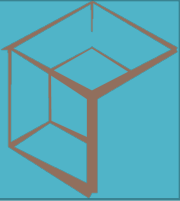


Main studies being conducted in innovation management


To enhance human creativity:

1. Brainstorming
group gathering spontaneous free no criticism contribution quantitative ideas
Alex Faickney Osborn / 1940s ~ 1960s / time consuming
2. Design thinking
hands-on user-centric fast prototyping
Stanford University / 1980s ~ 1990s / minimization of the role of technical knowledge and skills
3. **TRIZ** ★
invention-focused patent-originated 40 types of problem-solving mechanisms typological categorial
Genrich Altshuller, Soviet days / 1940s / difficult to be learned & trained, limits creativity
4. Open innovation
crowdsourcing Ideas from outside Idea collection
Henry Chesbrough from Berkley / 2006~ / lack of domain knowledge of crowd
5. Other remarks
success prediction on crowdfunding platform (using statistical models)
automatic idea generation (using Big data & deep learning) – e.g. Netflix

To start off: Subject data & samples



KICKSTARTER

- The biggest crowdfunding platform
- Posting ideas (“projects”) to get fund from “supporters” 

Explore **1939** projects



ZeTime: World's first smartwatch with hands over touchscreen


Proudly designed in Switzerland, the perfect always-on smartwatch blending classic design and smart...

 by **MyKronoz Switzerland** and 26,828 backers



Ticwatch S & E: A Truly Optimized Smartwatch


Powered by Android Wear™. Compatible with Android™ and iOS.

 by **Mobvoi** and 19,251 backers



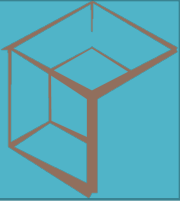
Thank you for supporting us!

A reusable, two-way protection, ozone-free mask that filters air pollutants, dust, smoke, droplets, pollen &...

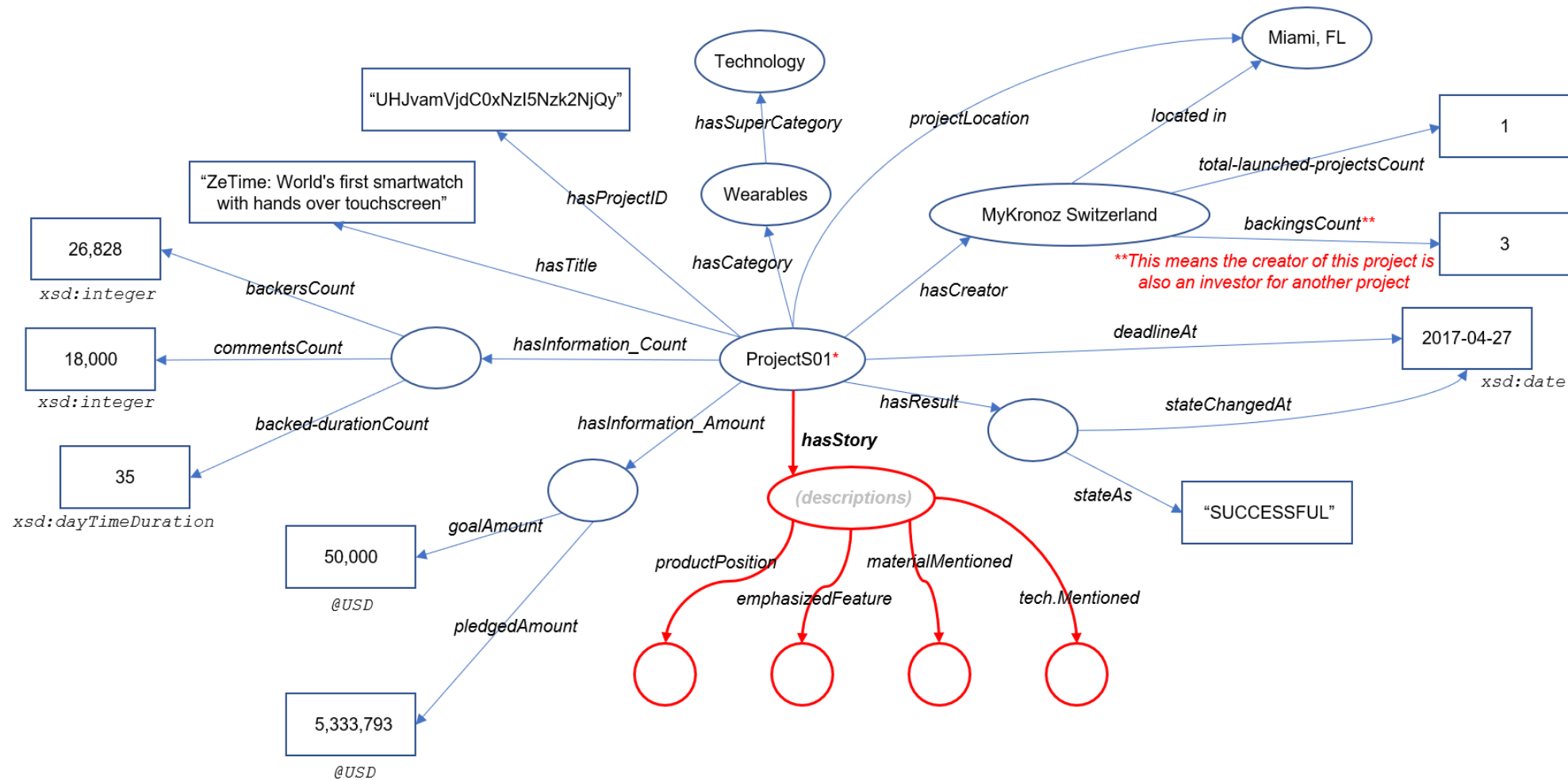
 by **UM Systems** and 14,404 backers

- Technology > Wearables
- Crawled 1,941 projects
- Qs
 - 1) What can be extractable from the idea?
 - 2) What can be ‘meaningful information’ for the research purpose?
 - 3) Does it make sense?
- Picked 100 samples
- Recognize entities by “DBpedia Spotlight”

To start off: Subject data & samples



* https://www.kickstarter.com/projects/1282890542/zetime-worlds-first-smartwatch-with-hands-over-tou?ref=discovery_category_most_backed

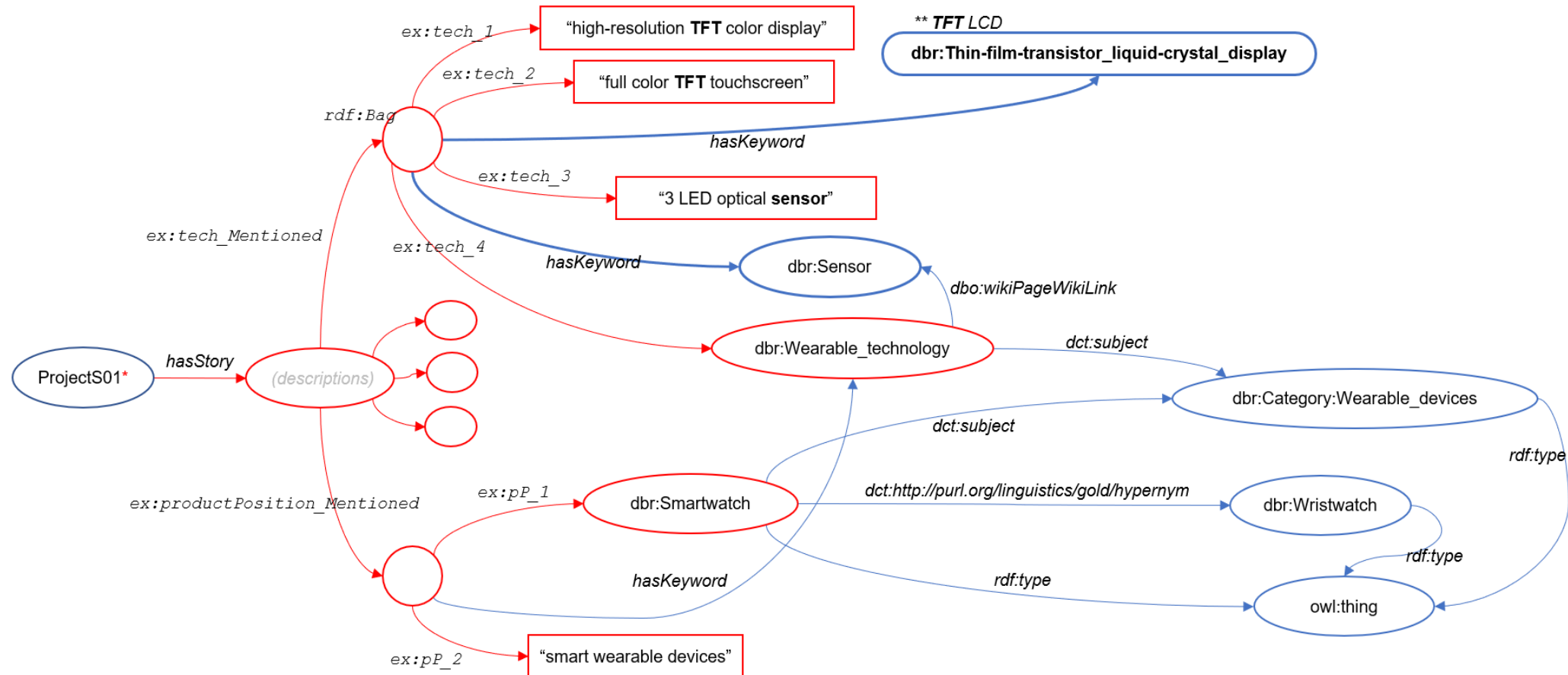




To start off: Subject data & samples

Red: based on the corpora from crawled project “story”, which is its description
Blue: from DBpedia (<https://www.dbpedia.org/about/>) queried by Triply

**** Please note that I couldn't show all of corpora crawled in this graph example. There are too many of corpora crawled to show all of them in this example.**



To start off: Subject data & samples



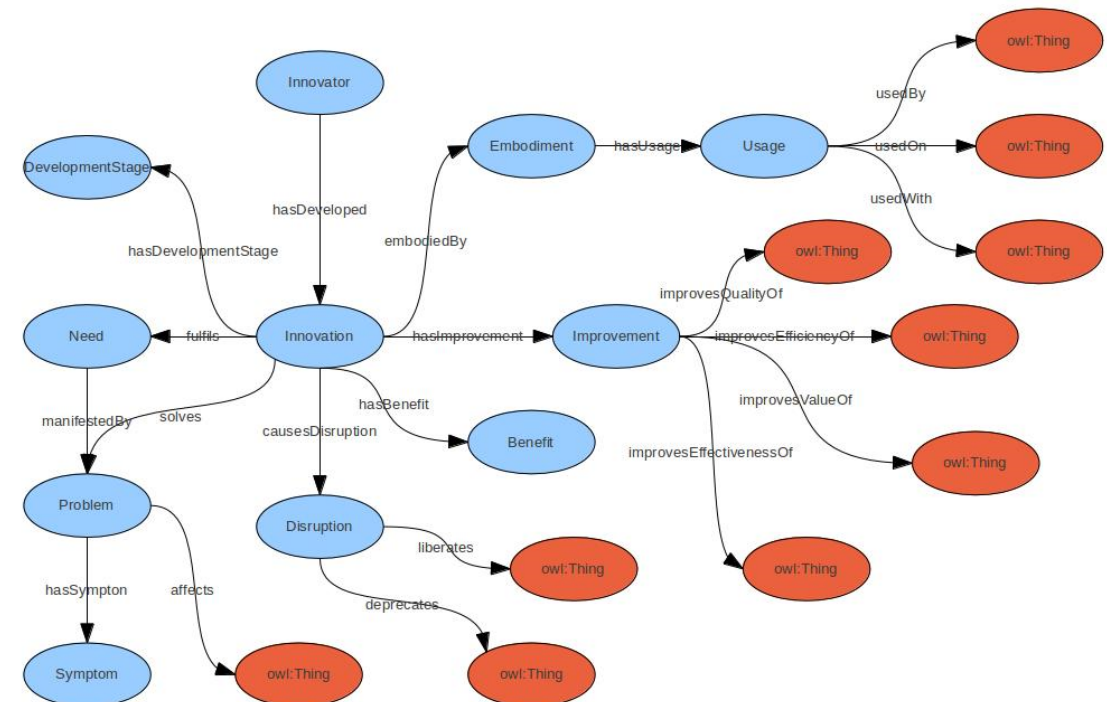
Confidence: Language:

☐ n-best candidates

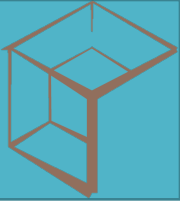
The first smartwatch with no compromises ZeTime the world first hybrid smartwatch combining mechanical hands with a full round color touchscreen. Using groundbreaking technology to mount watch hands through the center of the high-resolution TFT color display, ZeTime blends the classic design of a traditional timepiece with the most advanced features of a smartwatch. With its classic mechanical watch hands, powered by patented Smart Movement technology, ZeTime will automatically update the time according to your location and will work up to 30 days on a single charge. ZeTime innovation revolves around multi-layer technology combining a TFT color display, mechanical hands, a touch panel and ultra-resistant Gorilla glass. Patent pending Won the hands get in the way of the screen no, we've got that solved. With our Smart Movement technology, the mechanical hands are controlled by the watch CPU in order to move them if necessary to maximize visibility of the screen. Hands won't disturb you reading your emails or instant messages. We can simply ask them to move away from the text area to elegantly separate the screen in two horizontally. ZeTime Regular Shipping in September 2017 - ZeTime Petite Shipping in December 2017 Now two models to choose from: Regular (44mm) or Petite (39mm). ZeTime Regular timepiece boasts a sleek 44mm stainless steel watchcase inspired by the finest Swiss design, and will look effortlessly elegant on all wrists. However, for those who prefer a smaller model, ZeTime Petite will offer the same features, compatibility and finishings as ZeTime Regular, but in a compact 39mm watch case. No need to set the time when landing in a different time zone ZeTime will do it automatically in synchronization with your smartphone. Keep an eye on your hometown time zone too, thanks to custom watch faces. Today, smart wearable devices have changed the way we organise our day and connect with the world. But until now, there have been limitations compromises are made in design or quality of materials, in toughness and water

<http://www.lexicater.co.uk/vocabularies/innovation/ns.html>

Ontology for Innovation



To start off: Subject data & samples



Manual task + DBpedia spotlight (https://demo.dbpedia-spotlight.org/)								
No.	Sort	Entity	URL	dct: subject				
01	Tagged by	smartwatch	http://dbpedia.org/resource/Smartwatch	dbc:Navigational equipment	dbc:Mobile computers			
02	Mapped	touchscreen	http://dbpedia.org/resource/Touchscreen	dbc:European inventions	dbc:American inventions			
03	Mapped	TFT	http://dbpedia.org/resource/Thin-film-transistor_liquid-crystal_display	dbc:Display technology				
04	Mapped	mechanical watch	http://dbpedia.org/resource/Mechanical_watch	dbc:Articles containing video	dbc:Watches			
05	Tagged by	Smart	http://dbpedia.org/resource/Smart_device	dbc:Smart devices	dbc:Computer networking			
06	Mapped	Gorilla glass	http://dbpedia.org/resource/Gorilla_Glass	dbc:Glass applications	dbc:Glass engineering and design			
07	Tagged by	Patent pending	http://dbpedia.org/resource/Patent_pending	Manual picks	Classification	Personal note	Ontology Class description mapping	Ontology Class
08	Mapped	CPU	http://dbpedia.org/resource/CPU	mechanical hands	Entity		The physical/tangible manifestation of innovation	Embodiment
09	Mapped	stainless steel	http://dbpedia.org/resource/Stainless_steel	watch CPU	Entity	non-physical/tangible	The physical/tangible manifestation of innovation	Embodiment
10	Tagged by	Swiss	http://dbpedia.org/resource/Swiss	the mechanical hands are controlled by the watch CPU	Phrase		The physical/tangible manifestation of innovation	Embodiment
11	Tagged by	time zone	http://dbpedia.org/resource/Time_zone	move them* (<i>*mechanical hands</i>)	Phrase		The physical/tangible manifestation of innovation	Embodiment
12	Tagged by	synchronization	http://dbpedia.org/resource/Synchronization	to maximize visibility of the screen	Phrase	maximize	A benefit to something or someone	Benefit
13	Tagged by	smartphone	http://dbpedia.org/resource/Smartphone	Hands won't disturb you reading your emails or instant messages	Phrase	won't disturb	A benefit to something or someone	Benefit
14	Tagged by	battery	http://dbpedia.org/resource/Battery	move away* (<i>*mechanical hands</i>) from the text area to separate the screen	Phrase		The physical/tangible manifestation of innovation	Embodiment
15	Mapped	wearable technology	http://dbpedia.org/resource/Wearable_technology	stainless steel watchcase	Entity		The physical/tangible manifestation of innovation	Embodiment
16	Mapped	high tech	http://dbpedia.org/resource/High_tech	watch case	Entity		The physical/tangible manifestation of innovation	Embodiment
17	Tagged by	Sapphire	http://dbpedia.org/resource/Sapphire	for those who prefer a smaller model	Phrase	those who prefer	A need of/for something lack/requires improvement	0. Need
18	Tagged by	Caller ID	http://dbpedia.org/resource/Caller_ID	No need to set the time when landing in a different time zone	Phrase	no need	A benefit to something or someone	Benefit
19	Mapped	accelerometer	http://dbpedia.org/resource/Accelerometer	do it* (<i>*set the time</i>) automatically in synchronization with your smartphone	Phrase		The physical/tangible manifestation of innovation	Embodiment
20	Mapped	metal	http://dbpedia.org/resource/Metal	custom watch faces	Entity		The physical/tangible manifestation of innovation	Embodiment
21	Tagged by	watch face	http://dbpedia.org/resource/Watch_face	smart wearable devices	Entity		The physical/tangible manifestation of innovation	Embodiment
				there have been limitations compromises are made in design or quality	Phrase	there have been	The manifestation of a need	1. Problem
				water resistance	Entity		The physical/tangible manifestation of innovation	Embodiment
				smartwatch	Entity		The physical/tangible manifestation of innovation	Embodiment
				smartwatch may seem not so smart when its limited autonomy means	Phrase	may seem	The manifestation of a need	1. Problem
				push the limits of what is possible: there should be no compromise on	Phrase	push the limits	An improvements to something - more efficiency	Improvement
				navigation	Entity		The physical/tangible manifestation of innovation	Embodiment
				full color TFT touchscreen	Entity		The physical/tangible manifestation of innovation	Embodiment

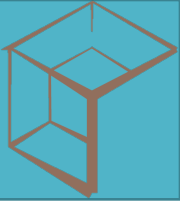


Using NLP techniques & Quantitative analysis to measure ...

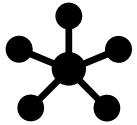
- A. How novel the idea is from the existing product or other ideas in the same product category?
- B. What kind of problem-solving mechanisms (by TRIZ ontology) were applied to the idea?
- C. Is there correlation between the degree of novelty & the result of idea selection (successful or not)?

1. Chang, D. (2021, June). Exploring the Potential of Knowledge Graphs to Support Distant Knowledge Search for Innovation. In 13th ACM Web Science Conference 2021 (pp. 147-148).

Overall research milestone



Build a KG
of Kickstarter story DB
Using NLP (NER/NEL)



Application
(Tool)

Innovators



1. The product category
- 2-1. The applied (or unapplied) problem-solving mechanism out of 40 types from TRIZ method
- 2-2. The frequency of use of the mechanism for the similar product
3.
 - ① The degree of novelty,
 - ② The rate of success in idea selection
 - ③ The correlation between them

Existing Ideas	Describe Problem	Describe Idea
<div>(1) What's already there?</div> <div>(2) What mechanisms were popularly used & not been tried yet?</div> <div>(3) The general novelty & idea selection scores</div>	<div>I think the current problem is that...</div> <div>Run</div> <div>✓ Have you ever thought about ~ mechanism to solve the problem...?</div> <div>✓ How about applying ~ mechanism to the situation?</div>	<div>A smartwatch made by patent technology of smart-movement and TFT color display touchscreen...</div> <div>Run</div> <div>▪ Expected novelty score: 0.375 (out of 1)</div> <div>▪ Success probability to be selected: 0.148 (out of 1)</div>



Thank you! 😊