One does not simply produce funny memes! – Explorations on the Automatic Generation of Internet humor

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Abstract

This paper reports on the automatic generation of image macro based Internet memes – potentially funny combinations of an image and text, intended to be spread in social networks. Memes are produced for news headlines for which, based on linguistic features, a suitable macro is selected and the text is adapted. The generation method is described together with its current implementation, which integrates a variety of tools and resources. Illustrative examples are also presented. Results of a human evaluation showed that, despite positive and neutral assessments, overall, automatically-generated memes are still below those produced by humans.

Introduction

Internet memes are a current trend, typically jokes, that gain influence through transmission in social media (Davison, 2012). A popular kind is the image macro – a set of stylistic rules for adding text (e.g. "*One does not simply X*", "*What if I told you Y*") to images, with a specific semantics. Most memes are a product of human creativity and their automatic generation is thus a challenge for computational creativity.

This paper reports on an exploratory approach for the automatic generation of Internet memes for news headlines – or better, protomemes, which may eventually become memes if spread through the Web. Following our previous work (Costa, Gonçalo Oliveira, and Pinto, 2015), where memes were generated for trendy people, towards whom famous quotes were adapted and added to their images, we now present a system with a similar goal, but with significant differences. Given a headline, MEMEGERA 2.0: automatically selects a suitable well-known image macro from a predefined set; adapts the text according to the macro rules; and combines the text with the image. The result is ready to be consumed. Following the recent trend of using Twitter as a showcase for linguistic creativity (Veale, Valitutti, and Li, 2015), an implemented Twitterbot posts a new meme every hour. Besides the main challenge, the bot's feed can be used as an alternative and funny way of following recent news.

The illustrative examples presented here, as well as the memes posted on Twitter, confirm that our main goal was achieved: given a headline, a coherent combination of image and text, easily recognisable as an Internet meme, and with a relation to the headline, is produced. A more challenging goal, discussed in the end of the paper, involves the production of novel artefacts with humor value. Though limited in terms of size, an evaluation survey pointed out that, despite frequently producing coherent text, there is work to do in the selection of the suitable image macros, as well as on the surprise and humor value of the produced artefacts. Yet, although better than MEMEGERA 2.0 overall, human-generated memes also failed to consistently reach top-performance, which shows that the creation of memes is challenging, even for humans.

In the remainder of this paper, we provide background knowledge and work on related topics, including computational linguistic creativity and computational humor. The meme generation method is then described and followed by details on its current implementation, for Portuguese, our native language. MEMEGERA 2.0 exploits a variety of tools and resources for collecting data, processing text, and for combining and publishing the results. Several illustrative memes generated by MEMEGERA 2.0 are then shown and contextualised. Before concluding, the conducted evaluation and its results are discussed.

Background and Related Work

Given a news headline, MEMEGERA 2.0 generates Internet memes that combine an image and a piece of text. This involves the automatic selection of an adequate image macro for the headline and the adaptation of the headline text according to the macro, with a humor intent. After a short introduction on the concept of Internet memes, this section enumerates previous work on computational linguistic creativity with a focus on humor generation. Not forgetting the role the image plays on the memes, the section ends with a reference to visual humor and its combination with text.

Internet Memes

The term *meme* originally refers to *an idea, behaviour, or style that spreads from person to person within a culture* (Dawkins, 1976). In the Web 2.0 era, it was adopted to denote *a piece of culture, typically a joke, which gains influence through online transmission* (Davison, 2012). A popular kind of meme is the image macro, which involves a set of stylistic rules for adding text to images. The same text can be added to different images or different text can be added to a common image. We focus on latter. Yet, the new piece of text should be analogous to the original, which is

either achieved by using a similar linguistic template or by transmitting a similar idea. Well-known memes of this kind include an image of Boromir, from the "Lord of the Rings", with a phrase that fills the template "*One does not simply X*", as an analogy to the original "*One does not simply walk into Mordor*"; Morpheus, from the "Matrix" movie, with "*What if I told you Y*"; or Batman slapping Robin, with a personalised text in their speech balloons.

Davison (2012) separates a meme into three components: manifestation – the observable part of the meme phenomenon; behavior – which creates the manifestation and is the action taken by an individual in service of the meme; and ideal – the concept or idea conveyed. For the memes by MEMEGERA 2.0, the manifestation is the image, the behavior involves adding a piece of text to the image, and the ideal is to make fun of an event through its analogy with previous uses of the macro.

Linguistic Creativity with a focus on Humor

The domain of computational linguistic creativity is discussed by Veale (2012), who highlights the Web as a large and open source of everyday knowledge, especially on the way language is used, and suitable for exploitation by creative systems. Linguistic creativity can take familiar knowledge, sometimes old-forgotten references, and re-invent it in novel and surprising ways. It often relies in the intelligent adaptation of well-known text to a new context.

Notable examples of computational linguistic creativity include the generation of metaphors, neologisms, slogans, poetry and humor. On the former, Veale and Hao (2008) exploit a small set of common textual patterns in the Web for acquiring salient properties of nouns, then used for explaining known metaphors and generating new ones (e.g. *Paris Hilton is a pole*). Smith, Hintze, and Ventura (2014) create neologisms by blending two concepts, either from language, or from pop culture lists (e.g. *neologism* + *creator* = *Nehovah*). Gatti et al. (2015) adapt well-known expressions (e.g. clichés, song and movie titles) to suit as creative slogans or news headlines in a four-step approach: (i) retrieval of recent news; (ii) keyword extraction; (iii) pairing news with expressions, based on their semantic similarity; (iv) replacing one word of the expression by a word related to the news, based on dependency statistics. For instance, given an article about the Euro crisis, the expression *What the world is coming to* may be adapted to *What the Euro is coming to*.

Lexical replacement has also been applied to other creative domains, such as poetry or humor. For instance, Toivanen, Gross, and Toivonen (2014) generate poems inspired by a news article through the replacement of certain words, in human-created poems, with associations obtained from Wikipedia and from the given article. Valitutti et al. (2013) explored the generation of adult humor, based on the replacement of a word in a short message. The new word should introduce incongruity and lead to a humorous interpretation, achieved by three constraints: (i) match the part-of-speech and either rhyme or be orthographically similar to the original word; (ii) convey a taboo meaning (e.g. an insult or sexual); (iii) occur at the end of the message and keep the coherence of the original sentence. An illustrative output is: *I've sent you my fart.. I mean 'part' not 'fart'....*

Humor has been studied from a variety of perspectives, such as psychology, philosophy, linguistics, and also via the computational approach. Raskin (2008) compiles research on humor, also covering an overview on computational approaches to verbal humor, up until 2008. Those cover different types of jokes, such as punning riddles or funny acronyms.

Early work by Binsted and Ritchie (1994) implemented the JAPE system for generating punning riddles. It exploits: a lexicon with syntactic and semantic information on words and their meaning; a set of schemata for combining two words based on their lexical or phonetic relationships; and a set of templates that render the riddle (e.g. *What do you get when you cross X with Y?*).

The HAHAcronym (Stock and Strapparava, 2005) system rewrites existing acronyms with a humor intent. It relies on an incongruity detector and generator that, after parsing existing acronyms, decides what words to keep unchanged and what to replace. Replacing words should keep the initial letter of the original and, at the same time, belong to opposing domains or be antonym adjectives, while also considering rhythm and rhymes (e.g. the acronym FBI may become *Fantastic Bureau of Intimidation*). Given a concept and an attribute, HAHAcronym can also generate new acronyms from scratch, which must be must be words in a dictionary (e.g. 'processor' and 'fast' results in OPEN – *Online Processor for Effervescent Net*).

Besides English, there were attempts for generating puns in Japanese (e.g. Sjöbergh and Araki (2007)), but we are not aware of any work of this kind for Portuguese.

In addition to those that share our final goal – to generate humor – the aforementioned works reuse familiar knowledge and adapt it to a new context, as MEMEGERA 2.0 does with the macros, known by the general audience and adapted to the context of a headline, obtained from the Web. Depending on the selected macro, text adaptations may range from none, to replacing a single word or longer fragment, in a similar fashion to those that rely on lexical replacement for producing different kinds of linguistically-creative artefacts. Given the key role of the images of memes, the following section focuses on humor through images or their combination with text.

Humor Generation with Images

Internet memes present some differences towards verbal humor and share some similarities with cartoons, which have also been studied from a scientific point of view Hempelmann and Samson (2008). For instance, meme characters may transmit emotions, which would have to be described in verbal jokes; and incongruity can be found in the picture, in the text, or in their combination.

Besides our previous approach (Costa, Gonçalo Oliveira, and Pinto, 2015), where an adapted quote was added to the image of a character, we are not aware of published material on the autonomous generation of Internet memes. Existing web services for aiding meme generation rely only on the user input of both images and text.

There is work, however, on exploring images to make chat conversations more enjoyable. CAHOOTS (Wen et al., 2015) is an online chat system that suggests humorous images, including memes, to be used in a conversation, based the last message or image received. Although the system does not produce humor autonomously, it is designed to maximize its use by humans, who decide whether to send the images or not.

Other automatic approaches for combining images and text include Grafik Dynamo (2005) and "Why Some Dolls Are Bad" (2008), by Kate Armstrong[1], where a narrative is dynamically generated by combining sequences of images, retrieved from social networks, with speech balloons. But the result is often non-sense.

Meme Generation Procedure

This section provides a high-level description of the current procedure for meme generation. Specific implementation details are provided in the next section.

Our current approach is significantly different our previous (Costa, Gonçalo Oliveira, and Pinto, 2015), where memes were focused on public figures (characters) trending on Twitter, and built from their image, retrieved from the Web, and a famous quote, where the last word was replaced by one associated to the character, given its presence in tweets that mentioned its name. Generated quotes were ranked by their humor potential, considering features such as ambiguity and slang. Besides being more limited than the current approach, it could use unlicensed images, and the result was potentially offensive to the involved characters.

On the other hand, the memes currently produced are more "traditional", in a sense that they reuse well-known macros with a text adapted according to their features. Another key difference is that memes can now be seen as an answer or commentary to a headline, and often serve as its creative rewriting.

For a given headline, the current generation procedure automatically: (i) selects a suitable image macro from a predefined set; (ii) adapts the text according to the selected macro; and (iii) adds the text to the image. More precisely, given a set of headlines H and a set of trigger rules for each supported macro M:

1. It checks whether each $h \in H$ matches any $m \in M$. If so, add the headline-macro pair (h, m) to the set of candidate pairs P;
2. If $|P| > 0$, select a subset $T \subset P$ where $(h, m)_t \in T$ mentions a Twitter trend. If $|T| = 0$, keep using P;
3. Select a random pair $(h, m)_r \in T$, adapt h's text according to m's stylistic rules, add the result to m's image, and return it.
4. If $|P| = 0$, the system can either do nothing or use a fallback meme, if there one is set (see next section).

Implementation

Although our method is language-independent, similarly to its predecessor, MEMEGERA 2.0 targets Portuguese. It is implemented in Java and exploits several available resources for the computational processing of Portuguese, as well as available Web APIs. It is also working as a Twitterbot, under the name *@MemeGera*. The generation procedure is repeated every hour, for the 25 most recent Portuguese news, and the result is posted in Twitter. A high-level architecture of MEMEGERA 2.0 is depicted in figure 1. First stage deals with data collection, the second assigns image macros to headlines, and the third combines the produced text and selected image.

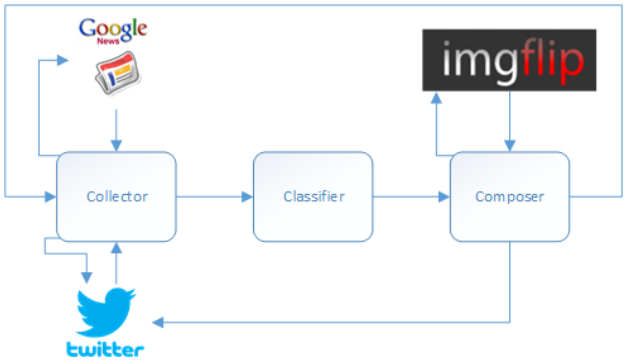


Figure 1: High-level architecture of MEMEGERA 2.0.

After describing the tools and resources involved in the implementation of MEMEGERA 2.0, this section uncovers lower level details of the developed headline classifier, including the currently supported image macros and the rules for pairing macros with headlines and to adapt their text.

Tools and Resources

Portuguese news headlines are collected automatically from the Google News RSS feed[2]. To minimise the generation of 'black humor', a filter is applied to discard headlines that mention deaths or casualties. In the last stage, the meme text is added to the macro with the help of the Imgflip API[3]. The resulting meme, ready to be consumed, is posted on the social network Twitter[4] with the help of Twitter4J[5].

The second stage is where linguistic resources are used. To select a suitable meme for a headline, the headline text is first part-of-speech tagged and lemmatised. For this purpose, a tagger based on the OpenNLP[6] toolkit is used with the Portuguese models, and with the LemPORT (Rodrigues, Gonçalo Oliveira, and Gomes, 2014) lemmatiser.

To identify the sentiment of the headline words, we use SentiLex (Silva, Carvalho, and Sarmento, 2012), where Portuguese words have their polarity annotated. When inflections are required to produce the resulting text, we resort to LABEL-LEX[7], a morphological lexicon for Portuguese. When verbs need to be nominalised, we resort to Nomlex-PT (de Paiva et al., 2014), a nominalisation lexicon for Portuguese.

[1] http://katearmstrong.com/

[2] https://news.google.com/news?cf=all&hl=pt-PT&pz=1&ned=pt-PT_pt&output=rss

[3] https://api.imgflip.com/

[4] https://twitter.com/

[5] http://twitter4j.org/

[6] https://opennlp.apache.org/

[7] http://label.ist.utl.pt/pt/labellex_pt.php

The identification of the most relevant word in the headline is simplified by the selection of the less frequent noun, verb or adjective, according to the frequency lists of the AC/DC project (Santos and Bick, 2000). The selected word has still to be in those lists. We also use the proverbs available in the scope of project Natura[8]. The semantic similarity between the headline and a proverb is computed by the average similarity between the nouns, verbs and adjectives they contain, using the PMI-IR (Turney, 2001) method on the Portuguese Wikipedia.

Covered Macros

A broad range of image macros is used nowadays on the social web. Some are more popular than others and each macro has its own style and semantics, expressed as a specific kind of message, either through a fixed textual template, an intention, or a sentiment, among others. We have looked both at popular memes and at a sample of headlines to manually identify textual regularities that would suit certain macros. Currently, MEMEGERA 2.0 covers the following, for which we describe the meaning, according to the *KnowYourMeme* website[9] (examples are shown in the next section):

- *Brace Yourselves* is used as an announcement of something.
- *One Does Not Simply* points out a difficult task.
- *Not Sure If* represents an internal monologue with underlying uncertainty.
- *Success Kid* transmits a successful achievement.
- *Sad Keanu* transmits a sad event.
- *Bad Luck Brian* transmits an embarrassing event.
- *Condescending Wonka* expresses a sarcastic message.
- *Ancient Aliens* explains inexplicable phenomena as the direct result of aliens.
- *Money Money* is related to (large amounts of) money.
- *Matrix Morpheus* reveals something unexpected.
- *Wise Confucius* gives an advice that turns out to be a pun.
- *Am I The Only One* voices the feeling of not following a trend.
- *X, X Everywhere* points out an emerging trend.

Pairing macros with headlines

In order to assign the most suitable macro to a news headline and to produce a meme, a rule-based classifier was developed to run on the headline text. Classification is currently based on a set of trigger rules over features extracted by the aforementioned linguistic resources.

Table 1 displays the rules applied for each macro and the text resulting after its adaptation to the macro. Some rules are very simple, such as those for *Am I The Only One* and *X, X Everywhere*, which are based on Portuguese trends in Twitter and do not use a headline as input. All the other rules require a linguistic processing of the headline and may rely on the occurrence of specific tokens (e.g. *One Does Not Simply*, *Not Sure If*), linguistic constructions (e.g. *Brace Yourselves*, *Condescending Wonka*), or sentiment-related features (e.g. *Success Kid*, *Bad Luck Brian*).

[8] http://natura.di.uminho.pt/~jj/pln/proverbio.dic

[9] http://knowyourmeme.com/

Besides those in the table, two macros are used as a fallback, in case not a single headline is paired with a macro.

- For *Matrix Morpheus*, the system looks for proverbs using the most relevant word of the text to add after "*E se eu te disser que*" (What if I told you). If more than one proverb mentions the word, the most semantically-similar with the headline is used.
- *Wise Confucius* is applied to headlines without a matching proverb and can be seen as an application of lexical replacement humor. It first selects a proverb that rhymes with the most relevant headline word, possibly computing the semantic similarity to solve ties. The last word of the proverb is then replaced by the headline word. The proverb is added after the text "*Provérbio Chinês*:" (Chinese Proverb).

The previous macros have less restrictive rules and are thus applicable to most pieces of text. The result might be more surprising than for the previous macros but, despite the computed similarity, it may also be non-sense.

Results

Figure 2 shows the results of MEMEGERA 2.0 with a selection of examples, originally posted on Twitter. For each, we present the original headline, in Portuguese, followed by an English translation. Behind the title, the meme is displayed, followed by a rough translation of its text, with the name of the macro in bold. When the headline text remains unchanged, only the name of the macro is displayed.

Evaluation

To have an appreciation of the produced memes, an evaluation survey was conducted in two stages. First, from a set of collected news headlines, a random selection was made. The same headlines were shown to three humans, familiar with the concept of Internet Meme, but not aware of MEMEGERA. Each human was asked to select a suitable macro for each headline, out of those supported by our system, and to write a suitable text for a related meme.

After that, a survey was created with the nine headlines and the four produced memes – one by MEMEGERA and three by humans – presented in a random order. For each meme, the following four features were to be classified with a Likert scale – *strongly agree* (5), *partially agree* (4), *neutral* (3), *partially disagree* (2) and *strongly disagree* (1):

1. Coherence: the text is syntactically and semantically coherent.
2. Suitability: the macro and text are suitable for the headline.
3. Surprise: the result is surprising.
4. Humour: the result produces a humorous effect.

We soon noticed that the surveys were too long, and divided the original survey into three parts, each with three of the original nine headlines and three memes for each – one of the human-created memes was randomly discarded. Volunteers were then asked to answer the survey online, through a web page that would randomly redirect them to one of the three parts. In the end, responses were given by 52 different subjects, without any special control, except that they were

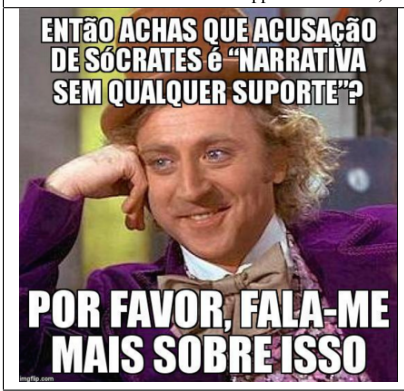
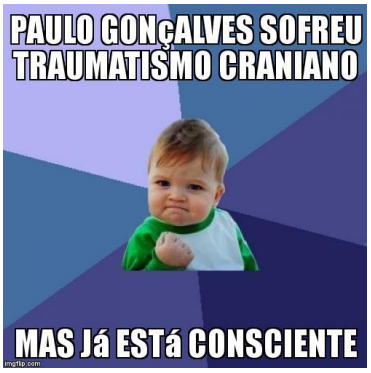
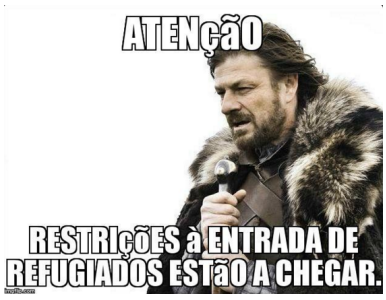
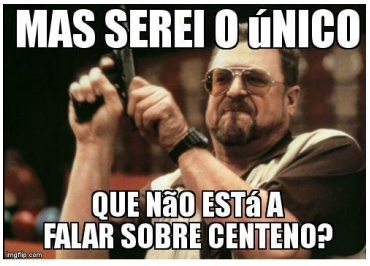
França: Sarkozy adverte políticos para não esquecerem primeira volta. (France: Sarkozy warns politicians not to forget the first round)	*Riade, Moscovo, Caracas e Doha acordam congelar produção de petróleo* (Riyadh, Moscow, Caracas and Doha agree to freeze oil production)	*"Maduro vai entregar um milhão de casas, ou corta o bigode"* (Maduro will provide one million homes, or he will cut his mustache)
One Does Not Simply forget the first round	Chinese proverb: money was made to be frozen **(Wise Confucious)**	Not sure if provide a one million homes, or if I cut my mustache (**Futurama Fry)**
Magistrados dizem que acusação de Sócrates é "narrativa sem qualquer suporte" (Judges say that Sócrates' indictment is an unsupported narrative)	*Erdogan ganhou mas perdeu.* (Erdogan won but lost)	*Paulo Gonçalves sofreu traumatismo craniano mas já está consciente* (Paulo Gonçalves suffered head trauma but is already aware)
		
So you think that Sócrates' indictment is an unsupported narrative? Please, tell me more about it **(Condescending Wonka)**	**(Bad Luck Brian)**	**(Success Kid)**
Merkel anuncia restrições à entrada de refugiados (Merkel announces restrictions on the arrival of refugees)	#Centeno	*Cidade do Futuro dentro de uma nave espacial estacionada em Braga* (Future city inside a spaceship parked in Braga)
		
Brace Yourselves restrictions on the arrival of refugees are coming	**Am I the Only One** not talking about Centeno?	**(Ancient Aliens)**

Figure 2: Examples of produced and published memes of different types.

Macro	Trigger (in headline h)	Resulting text
Brace Yourselves	h mentions an announcement, expressed by verbs in the present or future, e.g.: *X preparar/pleanear/projectar/anunciar Y*	*Preparem-se/Acautelem-se/Atenção ... Y (está a chegar)*
One Does Not Simply	h refers to an unfinished action, expressed by the adverb *não* (no) followed by a verb v, possibly followed by additional text and a preposition prp (*a, para, ...*), e.g.: *X não v (... prp)* Y*	*Simplesmente não se ... v Y / Y*
Not Sure If	h contains the alternative conjunction *ou* (or) opposing two ideas, e.g.: *... X ou Y ...*	*Não sei se X ... ou Y.*
Success Kid	h either: expresses a highly positive sentiment with at least three positive words; has a negative phrase ($P-$) followed by an adversative conjunction c (e.g. *mas*, but) and a positive phrase ($P+$)	*h/P- ... c P+.*
Sad Keanu	h is highly negative because it has at least three negative words.	h
Bad Luck Brian	h has a positive phrase ($P+$) followed by an adversative conjunction c (e.g. *mas*, but) and a negative phrase ($P-$)	*P+ ... c P-*
Condescending Wonka	h mentions someone's opinion or belief by the linguistic constructions: *X dizer/achar/acreditar/pensar que* Y*	*Então achas que Y? ... Por favor, fala-me mais sobre isso*
Ancient Aliens	h contains words related to the outer space domain (e.g. *NASA*, planet names, *extraterrestre*, *ovni*, *astronauta*, *espacial*, ...)	*h ... Aliens*
Money Money	h mentions large amounts of money through expressions such as: *milhão de euros/dólares* (million of euros/dollars)	h
Am I The Only One?	Twitter trend T	*Mas serei o único ... que não está a falar sobre T?*
X, X Everywhere	Twitter trend T	*T ... fala-se sobre T em todo lado*

Table 1: Covered image macros, their triggers and resulting text.

not the creators of the survey memes. We believe that most were not aware of the existence of MEMEGERA and those that were did not know much about its internal operations.

Figure 3 shows the median of all the responses given for the memes produced by MEMEGERA and by each human creator. Results show that MEMEGERA could not beat any human. On the linguistic coherence, though with a median of 4 (partially agree), it is one level below the humans, which reflects occasional errors that may occur in the text adaptation. On the remaining features, the median is always 3 (neutral), below all the humans on the humor feature, below two humans on suitability and the same as all humans in the surprise feature. This confirms that the generation of humor is a challenging task, also for humans, who did not get the maximum scores either, but especially for machines. Although based on a fixed set of rules, the surprise feature is comparable to the human-created memes. Here, MEMEGERA probably benefited not only from the surprise of the fallback memes, but also from the fact that its Twitterbot was not followed by the subjects. Otherwise, some memes would probably become less surprising, because their macro ends up being used several times with different headlines. To give a better picture of how responses spread, table 2 shows the number of memes assessed for each creator (#), followed by the means and standard deviation of the survey responses.

	#	Coherence	Suitability	Surprise	Humor
MEMEGERA	156	3.81±1.44	2.98±1.44	3.06±1.24	3.10±1.37
Human 1	133	4.14±1.22	3.17±1.55	3.27±1.27	3.29±1.44
Human 2	67	3.87±1.42	2.82±1.47	3.07±1.29	3.12±1.44
Human 3	112	3.95±1.38	3.40±1.50	3.24±1.32	3.16±1.57

Table 2: Means and standard deviation of survey responses.

Figure 4 depicts MEMEGERA's meme with the highest average scores in the survey, after the two human-created memes for the same headline. We highlight the high median on the surprise and humor features (4). Figure 5 depicts

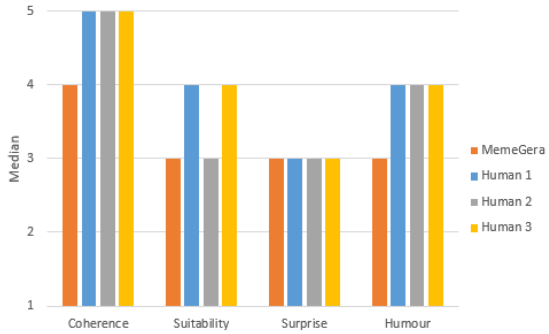


Figure 3: Median of the survey responses for MEMEGERA and for the human-generated memes.

the human-created meme with the best scores on average, followed by a meme by another human and MEMEGERA's. Although MEMEGERA's meme used the same macro as the first human-created, it is not as funny and the text is not even positioned with a top and a bottom part, as usual in these macros. Finally, figure 6 depicts MEMEGERA's meme with lowest scores, after the two human-created memes for the same headline. Once again, one human selected the same macro but, among other issues, MEMEGERA's had low coherence scores, to which a concordance mistake (*tenho* instead of *tem*) has contributed. This was already fixed.

Concluding remarks

We have presented a novel approach to the automatic generation of Internet memes based on news headlines, for which a suitable image macro is selected, with the help of a rule-based classifier that relies on linguistic triggers. The headline, possibly adapted according to the specific style of the macro, is added to the image.

Although focused on a short list of handcrafted linguistic rules, our main goal is achieved, as the produced artefacts

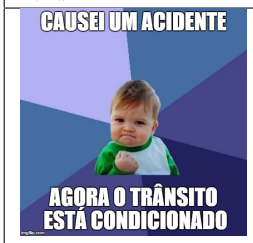
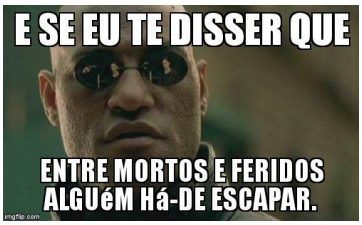
Headline: *Acidente faz nove feridos e condiciona trânsito no IC2* (Accident causes nine wounded people and conditions traffic on the IC2 road)		
Human 1	Human 2	MEMEGERA
		
(Caused an accident... now the traffic is conditioned)	(Accident causes nine wounded people... and conditions traffic on the IC2 road)	(What if I told you that... among the dead and the wounded, someone will survive)
coherence = 5; suitability = 3; surprise = 4; humor = 4	coherence = 5; suitability = 1; surprise = 3; humor = 2	coherence = 4; suitability = 4; surprise = 4; humor = 4

Figure 4: Best MEMEGERA's meme (on average) after the two human-created for the same headline.

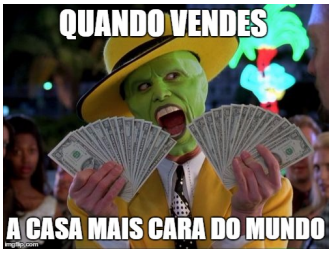
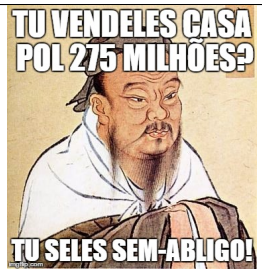
Headline: *Casa mais cara do mundo foi vendida em Paris por 275 milhões de euros* (World's most expensive house sold in Paris for 275 million euros)		
Human 1	Human 2	MEMEGERA
		
(When you sell... the most expensive house in the World)	(You sell house fo 275 million? You homeless!)	(World's most expensive house sold in Paris for 275 million euros)
coherence = 5; suitability = 5; surprise = 4; humor = 4.5	coherence = 2.5; suitability = 3.5; surprise = 4; humor = 3	coherence = 5; suitability = 4; surprise = 3.5; humor = 3.5

Figure 5: Best classified human-created meme, the other human meme for the same headline, and MEMEGERA's.

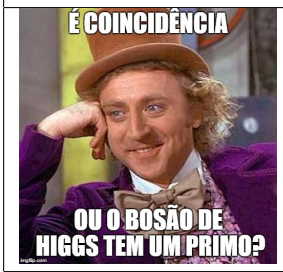
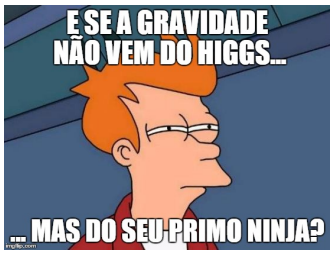
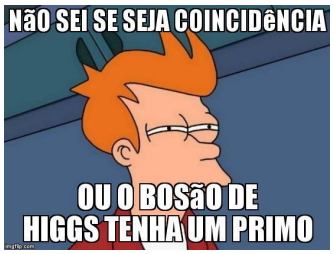
Headline: *É coincidência ou o bosão de Higgs tem um primo?* (Is it a coincidence or Higgs boson has a cousin?)		
Human 1	Human 2	MEMEGERA
		
(Is it a coincidence ... or Higgs boson has a cousin?)	(What if gravity does not come from Higgs ... but from its ninja cousin?)	(Not sure if it is a coincidence... or Higgs boson has a cousin)
coherence = 5; suitability = 2; surprise = 3; humor = 4	coherence = 5; suitability = 4; surprise = 3; humor = 3	coherence = 1; suitability = 3; surprise = 3; humor = 2

Figure 6: The worst of MEMEGERA's memes, after the two human-created for the same headline.

are easily recognisable as memes. Another strong aspect of this work is the integration of different available tools and resources which enabled us to go further. Current implementation targets Portuguese and uses a variety of natural language processing resources for this language, as well as Web APIs for collecting news, trends, producing the memes and posting a new meme, every hour, on Twitter. Despite other issues, the Twitterbot can be used for an alternative and funnier way of following recent news with a novel creative headline.

The first impression on the results is positive. They show coherence and are related to the headline. Yet, a comparison with human-created memes MEMEGERA 2.0 shows that there is still a long way to go, especially on producing actual humor. In fact, much humor value of the produced memes lies on the macros and the meaning they already carry.

Another limitation is the short range of covered macros and the closed set of rules. We admit that, after following the Twitterbot for a few days, one may get tired of the most frequently selected macros. Although we can add more macros, as we recently did, this opens up the discussion on whether MEMEGERA 2.0 is creative or not. Points for include the output, typically a product of human creativity, as well as the (creative) combination of different sources of knowledge for producing something new, but familiar. On the other hand, the selection of a macro is (almost) deterministic and, with the exception of the fallback memes, not that surprising, at least for frequent followers. Besides supporting more macros, in the future, variations of the current text transformations will be added, as well as refinements to the classifier towards making better-supported decisions. For instance, instead of relying on a binary classification – the headline suits the macro or not – the new classifier will consider additional features to score the headline-macro pair, such as the number of specific expressions (e.g. uncertainty-related for *Not Sure If*, difficulty-related for *One Does Not Simply*, sentiment words for *Success Kid* and *Sad Keanu*, or mysterious for *Aliens*). Moreover, given that most of the memes are commonly used with English text, it would definitely be interesting to adapt MEMEGERA to this language.

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