Psychological Attachment Style Determination Using a Word Space Model

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Abstract. In this work we experiment with the hypothesis that words a subject uses and their psychological attachment style (as defined by Bartholomew and Horowitz), can be related. In order to verify this hypothesis, we identified characteristic patterns for each style of attachment (secure, fearful, dismissing, preoccupied) by mapping words into a word space model on a series of autobiographic texts written by a set of 202 participants. Additionally, a psychological instrument (questionnaire) was applied to these same participants to measure their attachment style. A Support Vector Machine was trained, and we found that attachment style could be predicted from text within a range of 64% to 85% for different attachment styles.

Keywords. Psychological attachment, autobiography, text classification, support vector machines.

1 Introduction

The attachment theory was presented in 1969 by John Bowlby [3]. He states in it that humans generate patterns of their own affective ties and ways of interacting in their first years of life [11]; These patterns are generated with adaptive purposes based on experiences or life history [7].

Ainsworth and his team propose three styles of attachment: safe, anxious / ambivalent and avoidant [1].

> If the mother is sensitive and receptive to the need of her child, he will respond with certainty to the separation and the return of the mother. [...] If the mother is indifferent when he needs her and meddlesome when he does not need her,

the child will react with an attitude of anxiety / ambivalence by clinging to her sometimes and discharging his anger in others. [...] If he had systematically rejected his attempts to establish physical contact, the child would adopt an attitude of avoidance [10].

Later Bartholomew and Horowitz proposed one of the most accepted models of attachment today [15, 2], in which there are four styles of attachment that depend on two dimensions: the level of anxiety and intimacy, understood as the capacity to form close relationships (See Figure 1).

Mainly there are two ways to determine what style of psychological attachment a person possesses: the use of a self-report or the performance of an interview. The psychological interview is considered one of the most important methods for qualitative analysis in psychology; however, it is also one of the psychological methods that requires more training for applicators. This fact may represent a disadvantage in studies on attachment that require a large sample and do not have a sufficient number of interviewers.

On the other hand, self-reporting instruments can be generated and applied in different ways; however, these tend to present the problem of social desirability, which consists in a common bias of the truthfulness of the participants' responses when they do hypothesis about what the researcher wants to be answered, hypothesis generated from the content of the questions or test items of the instrument.
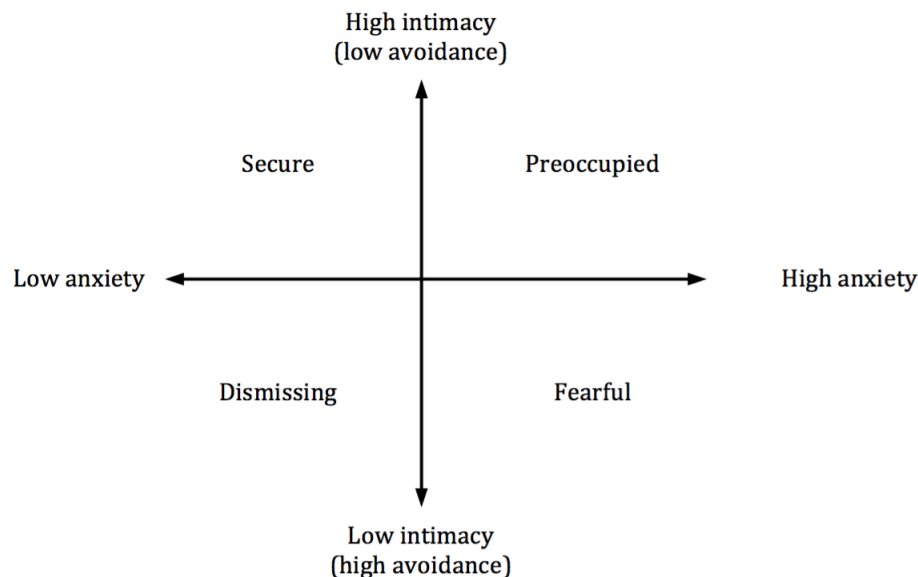
High intimacy
(low avoidance)

Secure

Preoccupied

Low anxiety

High anxiety

Dismissing

Fearful

Low intimacy
(high avoidance)

Fig. 1. Attachment styles as defined by Bartholomew and Horowitz

We consider that an alternative to these two traditional methods to determine the style of attachment is the linguistic analysis of texts generated by people without prior knowledge that they will be analyzed, or in their absence, without indicators that allow them to generate hypotheses about what the researcher wants. The form that we consider most adequate to carry out this linguistic analysis is by extracting linguistic patterns characteristic of each style of psychological attachment, so that later we can calculate the amount in which these patterns are found in a given text and in this way, classify the individual within one of the attachment styles.

Computational Linguistics is presented as one of the most important alternatives to search and measure these patterns. Thanks to the information processing power of computer science, we can carry out more quantitative studies. This gives the advantage of gaining objectivity with respect to other linguistic methods of a more subjective nature or whose quantification is more delayed when having to be done by humans.

The method that will be used to address the problem consists on using a word space model.

With it, a numerical representation of words will be generated from short autobiographies written by undergraduate students. Once each biography is represented in this way, an SVM (Support Vector Machine) will be trained to classify them under the four existing types of psychological attachment.

In case the linguistic patterns are found, these could serve as a basis to apply an instrument or measurement technique of attachment. In fact, this hypothetical measurement technique would have the advantage of not requiring the individual to be aware that he or she is being evaluated since this awareness involves the risk of a bias in their responses—for example, through social desirability or desire to please the experimenter.

Greater reliability in the results of the forms of measuring attachment has repercussions in the broad sectors where social psychology can be applied; that is, sectors such as education, public policies, market strategies, job training, clinical, among many others.

This research aims to create bridges between different areas of knowledge. Among these we can find Social Psychology, Computational Linguistics and Artificial Intelligence.

This is how an interdisciplinarity is achieved, one of the objectives that recurrently arise in current academic trends.

2 State of the Art

Psychology is closely linked to the recognition of patterns since its inception as a science with the founding of Wilhelm Wundt's laboratory in 1879. In this laboratory, an attempt was made to find patterns of perceptions, feelings, ideas, etc., by using the method of introspection [8]. Currently, pattern recognition remains closely related to the various branches of Psychology. For example, Psychophysiology searches for patterns within the waves thrown by electroencephalograms and seeks to associate them with different states such as wakefulness, sleep and coma, as well as pathological states such as epilepsy [4].

On the other hand, in Experimental Psychology different patterns of behavior are sought, usually in animals, by manipulating variables such as the delivery time of a reinforcer, the type of reinforcer and the action necessary to obtain it [5]. In Cognitive Psychology, patterns have been found in terms of reaction times, perceptions, memory, decision making and even in the same recognition of patterns that humans make [16]. Finally, Social Psychology is interested in patterns of attitudes, self-concept, persuasion, and all psychological phenomena related to the interaction of two or more individuals [14]. Attachment is a concept of Social Psychology and what it proposes is that each individual has one of four group of characteristic patterns to relate to the other (attachment styles).

James Pennebaker has studied a large number of topics that relate to Psychology with Linguistics using Computational Linguistics tools in various works. In his publications we can find works concerning the differences between the number of words used by men and women, the type of vocabulary and the subject of conversations between students, or the psychological implications of the use of natural language [12, 13, 18]. It is important to highlight the LIWC (Linguistic Inquiry and Word Count) program, software developed by Pennebaker and collaborators [17] that analyzes

a text by counting words and grouping them into categories previously defined by psychological dimensions such as emotions, self-references, causal words, etc.

Although there have been some approximations between Computational Linguistics and Psychology, we have not found in the literature any application of the first discipline to the specific subject of psychological attachment. This is why we consider important to explore this field with the help of natural language processing. In addition, research such as that of Song et al. [19] and Huynh et al. [9] reinforce the idea that behavior and intentions can be predicted from a linguistic analysis viewpoint, and therefore, that it is feasible to find linguistic patterns for each attachment style.

3 Proposed Method

Participants were instructed to write by hand a short autobiography or experience of approximately one page. Once the writing of the text was completed, they were asked to answer the Frías instrument [6] for attachment measurement.

The sample was composed by 202 university students of the UAM (Universidad Autónoma Metropolitana) campus Xochimilco and Iztapalapa. These students had an average age of 22.13 years with a standard deviation of 3.5. The age range was from 17 to 41 years; This is due to the fact that one of the characteristics of the student population of the UAM is the relatively high percentage of students who work or who resume their studies after several years of work. 51% of the participating population were men and the remaining 49% were women. Details are summarized in Table 1.

Based on the theory of Bartholomew and Horowitz [3], Frías' instrument [6] considers attachment as the result of the combination of two independent dimensions: avoidance and anxiety; therefore, the instrument results in a value for each of these dimensions. The instrument is composed of 36 items on a Likert scale that goes from 1 to 7 to indicate how well you agree with each of the corresponding reactive sentences, where 1 represents *nothing* and 7 *totally*.

Each test item is an affirmation about the way the participant feels about their close emotional

Table 1. Statistics on participants' age

Measure	Value
Mean	22.13
Median	21.50
Mode	21
Std. dev.	3.50
Range	12.29
Minimum	17
Maximum	41

relationships (romantic partners, close friends or relatives).

The results of the dimensions of avoidance and anxiety of the attachment scale were normalized in a range of -1 to +1 in order to facilitate the subsequent learning of the SVMs with the obtaining of a space of comparable dimensions bounded. They were also converted to the representation of the Horowitz and Bartholomew attachment types (secure, fearful, dismissing and preoccupied). An extract of the measurements of these dimensions is shown in Table 3. It can be observed that for each subject there are the scores of the measurement for anxiety and avoidance in its original scale (anxiety and avoidance in scale of 1 to 7), in its normalized scale (anxiety and avoidance in scale of -1 to 1) and in its version adapted to the four attachment styles mentioned above.

Subsequently, the autobiographies and experiences that were originally written by hand were transcribed into a text file, so that they could be preprocessed using the Perl programming language in order to preprocess the text for the facilitation of its subsequent analysis. This preprocessing refers to removing capitals, accents, and removing punctuation and articles, prepositions and pronouns. Except for this, the texts remained as they were originally written, maintaining even spelling and writing errors.

Once this was done, the text files of the autobiographies were converted into a numerical representation (word space model). In this representation, each of the blocks separated by a blank row represents an autobiography.

The first number of a block shows us the number of different words that the subject used when writing his autobiography. The first autobiography on Figure 2 has 95 different words, while the second one has 105.

In turn, each block consists of several words represented in numerical form:

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word index:  times the word is repeated
in the autobiography
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The index assigned to each word is in a separate text file and corresponds to the place occupied by each one when it is ordered alphabetically. See Table 3.

4 Experiments and Results

For these experiments, we used 202 autobiographies, from which 160 were used as training set and 42 as the test set.

We conducted two experiments. The first one considered each of the four types of attachment that can be formed based on the two dimensions of anxiety and avoidance. The second one considered only these latter two dimensions.

For our experiments we used a Support Vector Machine, as implemented by the Chasen group[1]. Our input set consisted in 160 autobiographies in their numerical representation of the word space model (as shown in Figure 2). For the first experiment, a separate training was carried out for each of the types of attachment: secure, fearful, preoccupied and dismissing.

For the *secure* type of training, the autobiographies of participants with this style of attachment were taken as positive values, while the autobiographies of the participants with the remaining types of attachment: *fearful*, *preoccupied* and *dismissing*, were taken as negative. This was repeated for each of the four types, which meant that in each training about 25% of the sample had positive values, and the remaining 75% had negative values. Then, each SVM was trained to recognize in the test set whether each autobiography belonged or not to the

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[1] http://chasen.org/~taku/software/TinySVM/

Table 2. Sample of attachment measuring on participants (using questionnaire)

Subject	Gender	Anxiety	Avoidance	Normalized Anxiety	Normalized Avoidance	Type of Attachment
1	F	4.5	3.83	0.1666	-0.0555	Fearful
2	M	2.17	3.66	-0.6078	-0.1111	Dismissing
3	F	2.11	2.88	-0.6296	-0.3703	Secure
4	F	2.55	3.88	-0.4814	-0.037	Dismissing
5	F	2.38	3.11	-0.5370	-0.2962	Secure
6	M	3.88	3.77	-0.0370	-0.0740	Fearful
7	M	2.17	3.55	-0.6078	-0.1481	Dismissing
8	M	4.05	3.83	0.0185	-0.0555	Fearful
9	M	5.27	3.55	0.4259	0.1481	Preoccupied

type of attachment analyzed. Before evaluating classification with the test biographies, we fed the SVMs with the same training data. All 160 cases were correctly classified. Then, we experimented with different kernels, with results as shown in Table 4.

Table 3. Word indexing

659	bulimia	bulimia
660	buques	ships
661	burlo	(I) mock
662	busca	(he) searches
663	buscando	searching
664	buscar	to search
665	buscaré	(I) will search
666	busco	(I) search
667	busear	to dive (wrong spelling)
668	busque	(that he) searches
669	búsqueda	search
671	caballero	gentleman
671	caballos	horses

In order to have a point of comparison for the results of these classifications, we selected as baseline to answer always negatively in all cases for each type of attachment; that is, the answer would be always an attachment style different to the one being analyzed.

Table 5 shows the number of negative cases for each attachment style. That is, for the style of secure attachment they are 83%, fearful 69%, dismissing 86% and preoccupied 62%. This baseline should be overcome by our method. In Table 5 *best results* obtained correspond to linear kernel for secure attachment style, second degree polynomial for fearful attachment style, third degree polynomial kernel for dismissing attachment style, and second degree polynomial for preoccupied attachment style. Only for the style of secure attachment the baseline could be surpassed.

Finally, for our second experiment, that considered only two dimensions of attachment, that is anxiety and avoidance, we used only two classifiers, instead of four. In this case, as can be seen in Table 6 the baseline is around 50% and we were able to obtain better results than in the previous experiment.

5 Conclusions and Future Work

In this work we presented the use of basic Computational Linguistics tools to try to find a relationship between the words used to write brief autobiographical and experiential texts by individuals of each of the four types of attachment according to the classification made with the instrument of Frías. For this hypothesis we relied on the statement that behaviors and intentions can be predicted from a linguistic analysis. To look for the possible aforementioned relationship, two experiments were carried out.

In the first experiment, the individuals were classified according to one of the four attachment

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Table 4. Results of classification accuracy for different kernels (percentages)

Kernel	Degree	Secure	Fearful	Dismissing	Preoccupied	Average
Linear	-	**85.71**	59.52	66.66	59.52	67.85
Polynomial	2	80.95	**66.66**	76.19	**61.90**	**71.42**
	3	80.95	64.28	**78.57**	61.90	71.42
	4	80.95	66.66	76.19	50.00	68.45
	5	78.57	66.66	78.57	45.23	67.26

Table 5. Comparison with baseline (Percentage of Accuracy)

Method	Secure	Fearful	Dismissing	Preoccupied	Average
Baseline	83.25	69.13	86.14	62.11	72.11
Best	**85.71**	66.66	78.57	61.90	71.42

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95 1855:6 3546:3 4195:3 430:3 1941:9 1488:3 1889:3 2729:3 4722:6 432:3 3013:6 254:3 4278:3 2772:3
1629:3 2657:3 2523:3 1940:3 3061:3 1447:3 4452:3 732:3 2974:3 1966:3 4189:3 4064:3 3451:3 2166:3
2832:3 4481:6 2954:15 4160:3 737:9 639:3 4606:6 736:3 1813:3 2146:9 2285:3 1900:3 4182:3 3048:3
1598:9 3273:3 674:3 4809:9 3647:3 1183:3 1077:3 4347:3 1623:3 3003:3 3458:3 333:6 1818:6 2799:3
1558:3 1116:3 1379:3 222:3 1957:3 2207:3 2206:3 3444:9 4441:3 523:3 2273:3 2209:3 4227:3 3133:3
4777:3 1325:3 485:6 3044:6 4589:3 2547:3 1611:3 584:6 3520:3 3600:3 2277:3 3083:3 1149:3 2298:6
3930:3 4759:3 1203:3 1646:3 1937:3 3786:3 1925:3 4358:3 1620:3 1642:12 36:6

105 4282:6 4490:3 3379:3 3805:6 3047:3 2197:3 2746:3 4625:3 816:3 252:3 438:3 2713:3 2147:3 401:3
3728:3 4655:3 2269:3 3646:3 2157:3 4594:3 2001:3 3736:3 1707:3 2173:3 2825:3 4812:3 3349:3 329:6
1466:3 1467:3 2954:9 4397:3 1677:9 3838:6 1951:3 1200:15 4306:3 1498:3 1347:3 4362:3 2146:6 4217:3
4072:3 1585:6 1598:6 1205:3 4560:3 4654:3 4538:3 4402:3 563:3 4809:3 1821:3 3354:6 3697:3 2354:3
3040:3 3631:3 1583:3 2292:3 1484:3 3704:3 1439:9 2906:3 1818:6 1604:3 3583:3 4304:3 4312:3 2900:3
3337:3 1329:3 351:3 151:3 1617:3 4190:3 3343:3 3446:3 1869:6 786:3 4589:3 4824:3 3970:3 1944:6
2358:9599:3 3504:3 308:3 2158:6 1055:3 4360:3 3614:3 2964:3 2328:3 417:3 2710:3 4572:3 2723:3 4063:9
35:3 73:3 88:3 61:3 60:3 71:3
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Fig. 2. Extract from numerical representation of auto-biographies

Table 6. Comparison with baseline for two dimensions (Percentage of Accuracy)

Method	Anxiety	Avoidance	Average
Baseline	49.32	51.15	50.24
Best	**57.20**	**72.43**	**64.82**

styles of the theory of Bartholomew and Horowitz. This classification was made based on the words that the participants used in their autobiographical texts. For this experiment, it was only possible to overcome the baseline for one of the four styles of attachment: *secure*, with 85% accuracy in classification. The baseline to be overcome was proposed based on the average percentage of negative cases existing for each of the samples.

For our second experiment, the four types of attachment of the previous phases were not considered. Instead, the two dimensions (anxiety and avoidance) that compose the attachment style were used, since this is the way they are reported by the used instrument of attachment measurement. As a result, a classification accuracy of 57.20% was obtained for the dimension *anxiety* and 72.43% for *avoidance*.

The configuration system used in this second experiment gave us the best results and, although

there is much room for improvement, it allowed us to affirm that there is a relation between the words used by the participants and their attachment style. We have used a word space model representation, where words like *child* and *girl* were words as different as *tree* and *run*. As a result, our model still can not be used as a substitute for the currently existing attachment measurement instruments.

In this work an attempt was made to avoid the use of additional resources such as dictionaries, syntactic analyzers and ontologies, in order to depend as little as possible on said resources and to measure the effectiveness of simple techniques that could be easily generalizable to other languages.

As a future work, we propose to complement the characteristics used with topics and other features, for example, automatically or manually extracted synonyms, grammatical categories of words, articles and word classification dictionaries, ontologies, etc. In this way, we believe that it would be possible to improve the classification accuracy of the participants with respect to their type of attachment.

Acknowledgments

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