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Context-aware Environments for Online Dispute Resolution

Davide Carneiro[1], Paulo Novais[1], Francisco Andrade[2], John Zeleznikow[3] and José Neves[1]

[1] Department of Informatics, University of Minho, Braga, Portugal
[2] Law School, University of Minho, Braga, Portugal
[3] School of Management and Information Systems, Victoria University, Melbourne, Australia

{dcarneiro, pjon}@di.uminho.pt, fandrade@direito.uminho.pt, john.zeleznikow@vu.edu.au, jneves@di.uminho.pt

Abstract: Virtual environments, such as Online Dispute Resolution, don't have the rich context of traditional environments do. We are developing a computational environment that can better support the decision-making process of experts by providing access to meaningful context information, allowing the intervenor to take better supported decisions. The resulting system is able to transparently acquire information about user's state, including stress or conflict resolution style.

Keywords: Online Dispute Resolution, Negotiation, Context-awareness.

1 Introduction

Personality traits, conflict resolution styles and emotional intelligence are some of the key determinants of how conflicts are resolved. Hence one may wonder how information technology can support the dispute resolution process (Lodder and Zeleznikow, 2010). Traditionally, conflicts have arisen between individuals in the geographical proximity of each other, after some kind of personal interaction (e.g. trade agreement, work relationship). However, nowadays conflicts can emerge between individuals located virtually anywhere in the world and may even involve non-human intervener and some kind of automated contracting process. This represents a significant change in the whole paradigm of conflict emergence and resolution. In that sense, conflict resolution is nowadays also a field of research in the Computer Science discipline.

The main consequence of this shift in the paradigm is that courts, shaped after the industrial revolution and still paper-based, are slow to deal with both the amount and the characteristics of these new disputes. In that sense, new approaches independent of concepts like geographical location or nationality and of paper based resources are needed.

The field of Online Dispute Resolution (ODR) (Katsh and Rifkin, 2001) emerged as a group of methods or techniques that allow the resolution of conflicts partially or wholly under an electronic environment and with the support of technological solutions (Lodder and Zeleznikow, 2010). Technology assumes such an importance that is seen as the fourth party in the conflict resolution process, together with the two opposing parties and the neutral (Rifkin, 2001). In that sense, ODR can be classified as first or second generation, according to the degree of autonomy of technology (Peruginelli and Chiti, 2002). First generation ODR describes systems in which technology is merely a facilitator of the contact between the parties or a document manager. It has no autonomy and doesn't play an important role. Second generation ODR comprises systems in which technology has the autonomy to make give advice or make decisions and may even be able to argue, to analyze complex information or to define strategies and plans. This is typically based on artifacts from Artificial Intelligence, including decision support systems or expert systems (Lodder and Thiessen, 2003).

In this paper we look at a very specific issue in Online Dispute Resolution: the implications of interacting and solving conflicts under virtual settings. In fact, as Rifkin puts it, in face to face mediation, the spoken word and the visual cues sparked by body language are the primary elements in the communication process. In opposition, in the "screen to screen" of ODR, the written word and the visual dimensions of the computer screen constitute these elements (Rifkin, 2001). This may have its advantages but certainly has disadvantages too, namely concerning the amount of contextual information (e.g. body language, emotions) that is absent in ODR.

In this paper, we make an analysis of the implications of the lack of context information in current ODR approaches and we present our approach, based on the concept of Ambient Intelligence (Aarts and Grotenhuis, 2011). Ambient Intelligence refers to the combined use of Ubiquitous Computing, Ubiquitous Communication and Intelligent User Interfaces to develop context-aware computational environments that are able to seamlessly acquire information from its users and take actions that aim at the maximization of some goal (e.g. user comfort or safety, efficiency at performing a task). Two main modules can be identified here: data acquisition from the environment and decision-making.

We are developing a context-aware conflict resolution environment to support the traditional model of Online Dispute Resolution by providing important information about the parties and their context (Carneiro et al., 2011). The main aim of this approach is to increase the amount of context information available so that parties and neutrals can take more realistic and weighted decisions. In that sense we are developing a framework that aims at interpreting the state of the parties (e.g. levels of stress, emotional state, conflict resolution style) and sharing that information with the conflict resolution platform. In the first stage we want to empower the neutral so that he can better decide on how to guide the process (e.g. make a pause when a party is too stressed, temporarily interrupt direct contact between parties, inform a party that their lack of cooperativeness is jeopardizing the process). In a posterior phase we aim at developing mechanisms that can efficiently inform parties about each other's states (e.g. animated avatars), making the conflict resolution process more human and closer to traditional ones in which people communicate face-to-face and are fully aware of the consequences of their acts.

2 Limitations of Communication in Virtual Environments

The fact that ODR takes place in a virtual environment, without all the richness of face-to-face interaction, is seen as a serious drawback (Larson, 2007). And this is true not only in the conflict resolution field but in any other field in which virtual environments are used. Virtual environments are frequently regarded as "cold", with emotions and other traces of our complex interaction means playing little to no role at all.

One of the most important aspects here is that of body language. In our day-to-day interactions we (unconsciously) rely on body language to express ourselves in a richer way. Mehrabian concludes that in a face-to-face communication there are three key elements: the words, the tone of voice and the nonverbal behavior (Mehrabian, 2009). The author also concludes that the non-verbal elements are particularly important for communicating feelings and attitudes, stating that they account for the majority of the information transmitted. i.e., the way that words are said is more important than the words themselves. The problem is that this information is lost in a virtual setting and makes it hard for the intervenient parties (e.g. mediators, disputants) to understand the emotional state of each other.

In a related line of research, Trevor et al. conclude that the lack of gestural information from both speaker and listener limits successful communication in virtual environments (Trevor et al., 2011). To support this conclusion, the authors created a communication game in which a player had to describe the meaning of a word to a partner so that she could guess the word. In this interaction, the partners could only communicate through animated avatars. These avatars could remain static, perform according to pre-record gestures or could be controlled by virtual reality suits worn by the first player. The results achieved prove that not only is body language very important for transmitting information but it is also used to perceive feedback from that transmission, i.e., to perceive if the communication is being successful or a different approach should be followed. Both the lack of feedback from the environment and the lack of meaningful content are pointed out as a drawback by other researchers (Campbell, 1997; Costalli et al. 2001).

When communicating online people tend to forget that there is another person behind the screen on the other side. In that sense, there is a disinhibiting effect and people tend to forget about the other's feelings and simply don't worry that much about the consequences of the words they utter and the actions they commit. Thus it is often easier to offend people online. This may constitute an important obstacle to the successful resolution of the conflict as a relation of trust is of utmost importance.

It is thus evident that the lack of the context of personal interactions constitutes a drawback in a virtual conflict resolution process. Context information is needed not only for parties to take better and more realistic decisions but also to interpret how others are being affected by the issues and to keep in mind that in the other end of the screen there are people with feelings, desires and fears. With this motivation in mind, in the next section we present our approach in which we aim to empower virtual conflict resolution mechanisms with the provision of context information in real-time about the parties and the interaction environment.

3 Building a Context-aware Conflict Resolution Environment

The main objective of this research is to build a transparent computational environment that can support the conflict resolution system with the provision of meaningful context information. In that sense, we are extending the traditional model of negotiation/mediation with two new components: an intelligent environment and an adaptation phase.

On the one hand, we are including the notion of an intelligent environment as an abstract and transparent entity, built on devices and sensors. It is transparent in the sense that it is invisible to the eye of the user. Ideally, the user won't even know that he is being monitored as the simple fact of knowing this may be enough to change his behavior. This environment surrounds the users and constantly acquires information about them and their context of interaction by means of regular devices with computational power (e.g. touch screens, video cameras, accelerometers, PDAs).

On the other hand, we include an adaptation phase. This phase occurs whenever the mediator notices a significant change in the context of interaction that calls for a rethinking of the strategies defined. The main objectives of this phase are to re-orient the focus of the conflict resolution process in order to keep the parties interested in its resolution and to find more suitable ways of achieving an outcome.

Thus, we define a dynamic context-aware conflict resolution model as depicted in Figure 1. The process starts with the generation of useful knowledge that will support the decisions of the disputant parties and allow for the mediator and other tools (e.g. expert systems, decision support systems) to make better decisions. With the support of this knowledge, the mediator will build the strategies that will guide the negotiated process. Whenever the mediator feels that it is necessary, he may choose to adapt these strategies. In order to decide when and how to perform this adaptation, the mediator interprets the information provided by an intelligent environment about the context of interaction, including the levels of escalation, the attitudes, the personal conflict styles, the emotional state or the levels of stress. This process goes on until a party exits the process or a successful agreement is reached. In the following sub-sections we depict some of the information that the intelligent environment provides and how it acquires it.

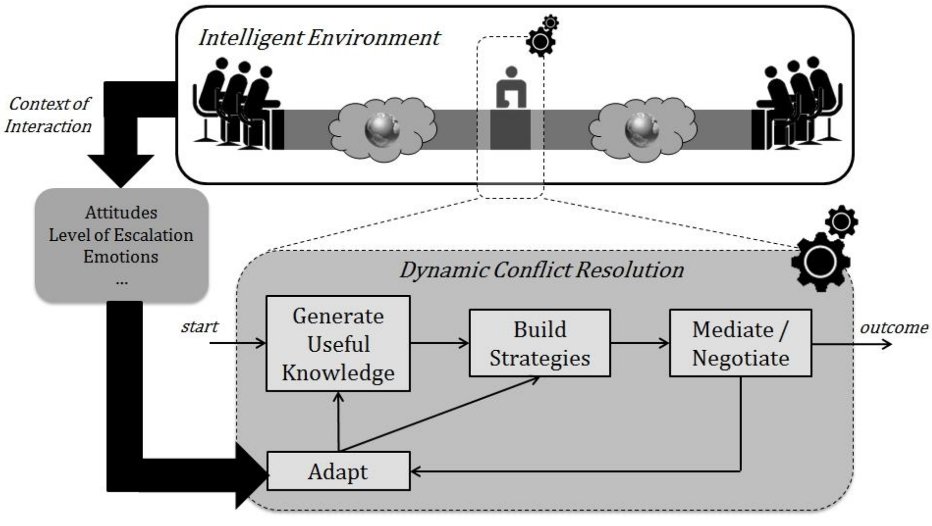

Fig. 1. High level view of the proposed context-aware conflict resolution model.

3.1 The Automated Classification of Personal Conflict Resolution Styles

Each individual has a different style of dealing with a conflict. This so-called personal conflict style is a result of our personality traits, our past experiences and many other issues. One's personal conflict style is one of the most important issues influencing our decisions in a conflict resolution process and, consequently, its outcome. In that sense, knowledge about how each party behaves in a conflict scenario is of utmost importance for the mediator. Moreover, detecting, interpreting and even inducing changes in this personal conflict style may be a very powerful weapon for the mediator in order to achieve a successful outcome. Thus, understanding personal conflict styles should be regarded as essential in a conflict resolution process.

In the 1970s behavioral scientists Kenneth Thomas and Ralph Kilmann classified the way we respond to conflict scenarios in five different modes, in terms of the individual's assertiveness and cooperativeness (Thomas and Kilmann, 1974)[1]:

- Competing - A competing individual will have as its main purpose the achievement of the highest gain possible. In order to achieve it, the individual may use his ability to argue, his rank, economic sanctions or whatever power seems appropriate. This style is highly uncooperative;
- Accommodating – An individual showing an accommodating conflict style will show the openness necessary to accept another's point of view and may even evidence selflessness, generosity or charity. In fact, the individual may even neglect his own gain to maximize the gain of the other. In that sense, there is an underlying element of self-sacrifice in this cooperative style;
- Avoiding – When an individual evidences an avoiding style of dealing with the conflict he will most likely try to not deal with the conflict at all, i.e., he will not try to satisfy his interests nor the ones of the opposing party. This style might be visible through behaviors such as the sidestepping or postponing of an issue or withdrawing from a threatening situation;
- Collaborating – A collaborating individual is willing to explore a disagreement to learn from others' insights. This style is the complete opposite of the avoiding one in the sense that it is cooperative and the individual tries to satisfy the interests of both parties, placing effort on discovering the underlying desires and fears of the other.
- Compromising – A compromising individual will try to split the differences between the two positions, exchange concessions or seek a quick middle-ground solution. Basically, he will try to find some expedient and mutually acceptable solution that partially satisfies both parties. This style can be seen as an intermediate one between the competing and accommodating ones.

Although the authors argued that disputants tend to focus upon one specific conflict style, depending on the situation, they might use different styles. The styles the parties use can be determined following two different approaches:

A) On the one hand, parties can be questioned about how they would behave in certain scenarios. This provides information before the actual start of the process, allowing the mediator to plan ahead. However, this information may not be reliable as people tend to behave differently when they are under stress and it is fairly easy to give wrong information in questionnaires. Moreover, people will most likely change their conflict resolution style during the process, making the initial information outdated.

B) On the other hand, the behavior of the parties may be analyzed while they interact. Although this process may require more time to gather enough information about the parties, it will not only be more reliable information but it will also reflect eventual changes in the style, and in real time.

In this work, we focus on the interpretation of conflict styles during the negotiated process, by analyzing the behavior of the parties in real time, allowing us to infer the conflict resolution style of the parties while they interact. Specifically, we analyze the actions that parties take during the negotiation, in which parties can ignore, accept, refuse, exit, reply with a new proposal or reply with a counterproposal. The simple fact of performing a task has its specific meaning: a party that is simply refusing or ignoring a proposal is probably in an avoiding style while a party that replies with a counterproposal addressing the original proposal is often cooperating. However, the action by itself is not enough. In fact, the utility of the proposals that are constructed by the parties must be analyzed. This allows the mediator to determine to which extent the party is just being greedy (he cooperates by proposing solutions that encompass only his personal gain, and does not propose unrealistic solutions) or to which extent he is willing to propose

[1] Also known as the *Thomas-Kilmann Conflict Mode Instrument*

middle ground solutions (he proposes to lose part of the possible gains in order to achieve an outcome). The analysis of this utility is central.

In order to correctly interpret each action, the utility of the proposal it encapsulates must be analyzed and compared with boundary values. In that sense, the utility is analyzed in comparison with the values of the BATNA, WATNA and ZOPA. BATNA and WATNA represent the Best and Worst Alternative to a Negotiated Agreement and depict the best and worst case scenarios in court, i.e., if the alternative method fails what are the chances in court? (De Vries et al., 2005). The ZOPA, on the other hand, represents the Zone of Possible Agreement and, as the name indicates, describes the range of possible outcomes (Raiffa, 2005). The way that these values are computed in the context of this work is further described in (Andrade, 2010). This analysis is performed under the assumption that a value of utility near the BATNA of the party stands for a greedy behavior (a more competitive style) whereas a value near the WATNA represents a more compromising one (Figure 2). This analysis is performed in each round of the negotiation process, in which parties exchange proposals and counterproposals.

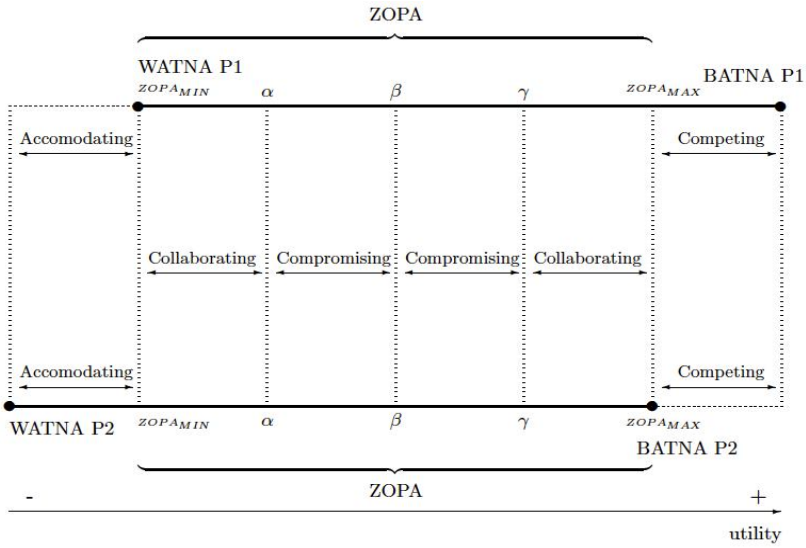

Fig. 2. The space that defines the personal conflict styles in function of the utility of the proposals and the values of the BATNA, BATNA and ZOPA.

In each round, each party will perform actions which will contribute to the overall characterization of its personal conflict style. This is thus the result of an ongoing process, i.e., a single action is not enough to accurately classify the style of the party. In this process of classifying styles two main scenarios are possible: the party ignores the proposal or the party answers to the proposal. If the party ignores the proposal, in that round his behavior is classified as *Avoiding*. On the other hand, if the party answers, the utility of the answer is analyzed.

First of all, a legitimate and valid answer evidences a cooperative behavior. However, we must determine what the real intentions of the party are. If the utility of the proposal is near the BATNA of the party, he is clearly showing a *Competing* style as he is trying to maximize his own gain. He might even be doing this in an unrealistically way, completely disregarding the other party. On the other hand, if the utility of the proposal is near the WATNA, the party may be neglecting his own gain or even maximizing the gain of the other. In such a scenario, it is reasonable to state that the party is showing an *Accommodating* behavior. If the utility of the proposal falls within the range of the ZOPA, the party is being reasonable and proposing a solution that may comprise losses on both sides but is certainly reasonable. In this case, style is determined in function of the distance to the mean point of the ZOPA, as defined in equation 1.

$$\beta = \left(\frac{ZOPA_{MIN} + ZOPA_{MAX}}{2}\right) \quad (1)$$

Additionally, two intermediary points are defined that allow to classify the remaining conflict styles, equations 2 and 3. Specifically, when the utility belongs to $[\alpha, \gamma]$, it denotes a party negotiating in

intermediary points of the ZOPA. That is, the party is trying to work out compromise that implies a loss from both parties. In such a scenario, it may be said that the party is evidencing a *Compromising* behavior. On the other hand, if the value of the utility belongs to $[ZOPA_{MIN}, ZOPA_{MAX}]/[\alpha,\gamma]$
The party is making proposals that are closer to the limits of the ZOPA. This means that the party is trying to work out a solution but may also mean that the party is trying to explore some weakness of the other party, trying to force him to accept a more extreme solution. In this case, the style of the party is classified as *Collaborating*.

$$\alpha = \left(ZOPA_{MIN} + \frac{\beta - ZOPA_{MIN}}{2}\right) = \left(\frac{ZOPA_{MIN} + \beta}{2}\right) \quad (2)$$
$$\gamma = \left(ZOPA_{MAX} - \frac{ZOPA_{MAX} - \beta}{2}\right) = \left(\frac{ZOPA_{MAX} + \beta}{2}\right) \quad (3)$$

However, given that we might use several styles at the same time and that a value that is near the limit of the interval should have a different meaning from a value that is in the middle, we propose a more accurate approach in which a main conflict style is inferred, together with a so-called trend style. This can be interpreted as a party showing a given behavior but with a trend to another one. The following notation is used to denote a main conflict style with a trend to a secondary one: $Main_{\rightarrow secondary}$.

Let φ be the value of the utility of a proposal. The following personal conflict styles are defined:

$$Collaborating_{\rightarrow Accomodating} \quad if\ \varphi \in [ZOPA_{MIN}, \frac{ZOPA_{MIN} + \alpha}{2}[$$
$$Collaborating_{\rightarrow Compromising} \quad if\ \varphi \in [\frac{ZOPA_{MIN} + \alpha}{2}, \alpha[$$
$$Compromising_{\rightarrow Collaborating-Accomodating} \quad if\ \varphi \in [\alpha, \beta[$$
$$Compromising_{\rightarrow Collaborating-Competing} \quad if\ \varphi \in [\beta, \gamma[$$
$$Collaborating_{\rightarrow Compromising} \quad if\ \varphi \in [\gamma, \frac{ZOPA_{MAX} + \gamma}{2}[$$
$$Collaborating_{\rightarrow Collaborating-Competing} \quad if\ \varphi \in [\frac{ZOPA_{MAX} + \gamma}{2}, ZOPA_{MAX}]$$

Doing this in each round allows us to analyze the evolution of the conflict resolution styles in a temporal perspective (Figure 3), in an attempt to try to identify some pattern or trend (e.g. an apprehensive party starts out showing and avoiding behavior and then evolves towards a more collaborative or compromising one). With access to this kind of information, the mediator may better decide on when and how to adapt strategies.

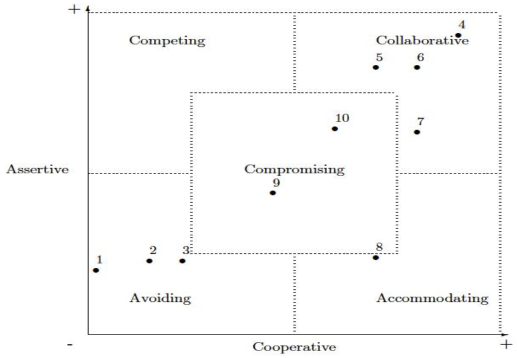

Fig. 3. Representation of the evolution of the personal conflict style of a party in 10 rounds.

3.2 A Non-invasive Estimation of the Level of Stress of Disputants

Stress is an abnormal condition that disrupts the normal functions of the body or mind. In other words, human stress is a state of tension that is created when a person responds to demands and pressures. It can affect the body, thoughts, feelings, and the behavior of a person (Selye, 1956). In that sense, its analysis in a conflict resolution scenario is of utmost importance. However, when the conflict resolution process takes place in an online environment, information about the underlying stress is not available. As a consequence, the intervener loses access to important interaction information that may allow him to assess how each issue effects each party and to what extent this occurs. In this line of research, we aim to empower ODR settings with estimated information about the levels of stress of the parties.

Stress has spawned a vast body of research in the health literature (Jones and Kinman, 1988). In fact, some research areas on the topic of stress can be identified, namely: (1) stressors (the environmental causes of stress), (2) intervening variables and (3) strains (the outcomes of stress). Moreover, these areas are interlinked and these categories are not mutually exclusive, which has led to misunderstanding in academic and popular writing on stress.

It is a rather challenging task to develop a practical human stress monitoring system. Several difficulties arise from this task, namely: (1) the expression and the measurements of human stress are very much person-dependent and even time or context dependent for the same person; (2) the sensory observations are often ambiguous, uncertain, and incomplete; (3) the user stress is dynamic and evolves over time; (4) the lack of a clear criterion for feasible stress states greatly increases the difficulty of validating stress recognition systems.

The ability to recognize common stress symptoms and, furthermore, the underlying causes, is crucial to understand the factors that conduct the user's performance to perform an action or evidence a behavior. Our current work focuses on modeling a system that is able to estimate the level of human stress from its external symptoms. We are developing a non-invasive real-time system that monitors human stress in a task-specific environment. This approach is based on the use of handheld devices that are used to interact with the conflict resolution system. These handheld devices are equipped with sensors that can provide useful information in real-time about how the users interact with the platform, in a transparent way.

Currently, our solution considers the following inputs:

- Touch patterns – The touch pattern encodes the specific way of the user touching the handheld device. Stressed and calm users show different touch patterns;
- Touch accuracy – The accuracy of the touch refers to the precision with which the user touches or fails to touch the controls. Lower levels of accuracy are related to increased levels of stress;
- Touch intensity – The touch intensity depicts the pressure of the touch. Generally, a stressed touch has a higher maximum value of intensity than a calm touch;
- Acceleration – Information from the accelerometer placed in the handheld device can allow to determine the level of agitation of the user: stressed users tend to move more and in more abrupt ways than calm users;

Concerning touch patterns, each user has a specific touch pattern. However, these touch patterns are affected by stress in similar ways, even for different users (Grundlehner et al., 2009). Touch patterns can vary in length and in the variation of the intensity during the touch (Figure 6b). Generally, a touch performed in a calm state starts in or near a maximum value of intensity and then decreases until the finger releases the screen. On the other hand, a touch performed under stress tends to last longer, with its intensity increasing until a maximum value (that is higher than the maximum value of a calm touch) is reached. After this point, the intensity decreases until the finger releases the screen. In that sense, even for different users, it is possible to develop an algorithm that is able to distinguish between a more stressed and a more relaxed touch. Still, better results are achieved with a prior phase of training, in which the system adapts to the specific touch pattern of the user.

To make this distinction between stressed and calm touches we look at the intensity curves of the touches. Given that the usual shape of the intensity of a touch is similar to a quadratic function, we use a least-squares fit to obtain the curve that best fits the touch pattern. Figure 6a shows a touch pattern (orange line) and the corresponding curve generated by the least-squares fit (in blue). Thus, after being processed, the touch is no longer represented as a list of points of intensity but as a quadratic function of type

$$f(x) = ax^2 + bx + c\,, a \neq 0.$$

This allows us to compare touches by comparing their respective curves (e.g. similar curves denote similar touch patterns). We thus use machine learning techniques to classify each touch. Specifically, we trained a J48 algorithm to be able to distinguish between a stressed and non-stressed touch, using a dataset of 349 touches. The resulting tree is used to distinguish between stressed and non-stressed touches (Figure 4).

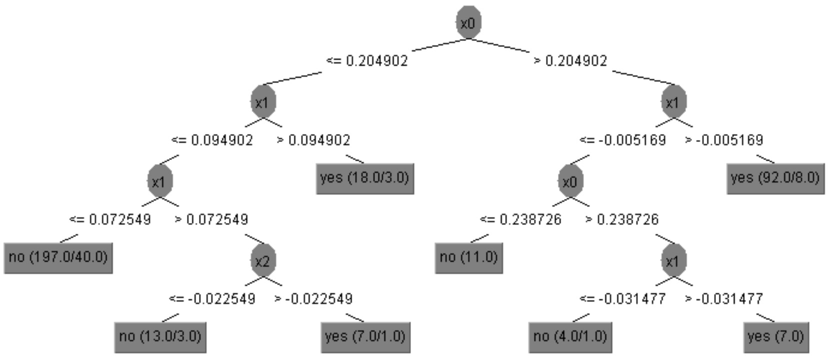

Fig. 4. The tree created by the J48 classification algorithm. This tree is used to distinguish between a stressed and a non-stressed touch.

The algorithm shows interesting results, with 271 out of 349 correctly classified instances (around 78%) (Figure 5).

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=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         271               77.6504 %
Incorrectly Classified Instances        78               22.3496 %
Kappa statistic                          0.5457
Mean absolute error                      0.2876
Root mean squared error                  0.4155
Relative absolute error                 58.1595 %
Root relative squared error             83.5666 %
Total Number of Instances              349

=== Detailed Accuracy By Class ===

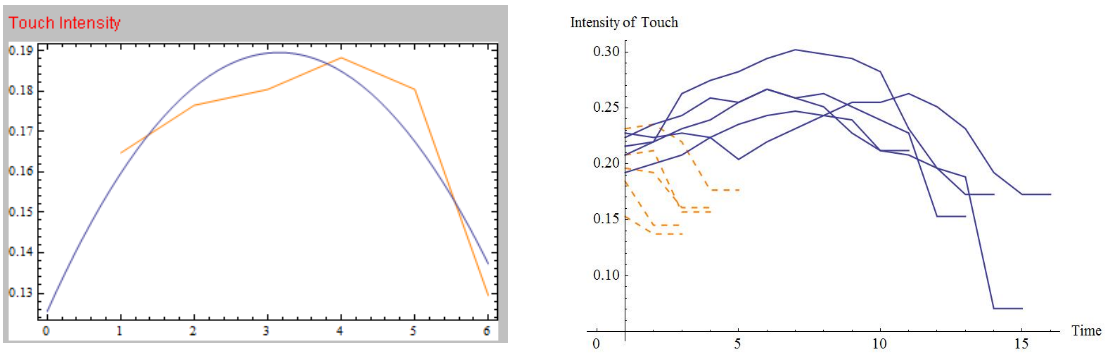
               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.724     0.181      0.764     0.724     0.743      0.807    yes
                 0.819     0.276      0.786     0.819     0.802      0.807    no
Weighted Avg.    0.777     0.233      0.776     0.777     0.776      0.807

=== Confusion Matrix ===

   a   b   <-- classified as
 113  43 |   a = yes
  35 158 |   b = no
```

Fig. 5. Summary of the model used to classify touches.

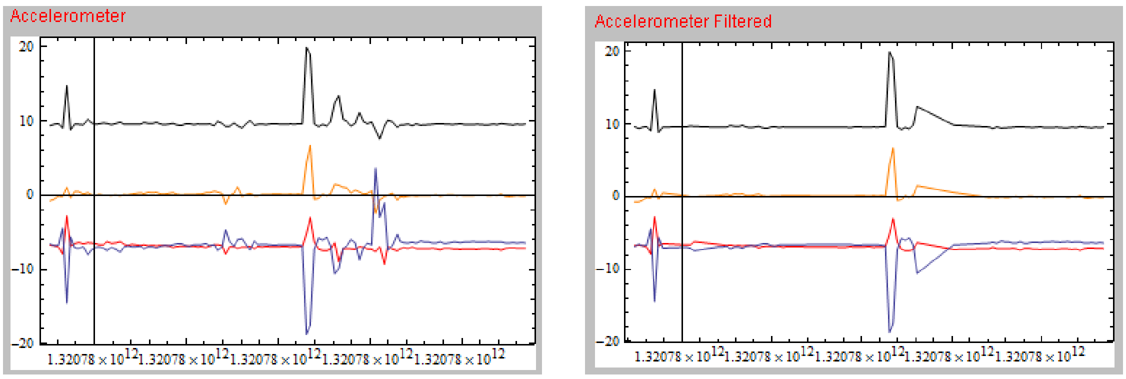
After building this model, the system is ready to classify touches as stressed or not stressed. Evidently, a single touch is not enough to accurately classify the user's state. In that sense, we follow a temporal approach in which each touch contributes to the overall estimation of the level of stress. Together with this information, we also analyze the accuracy and maximum intensity of the touch. The accuracy represents the amount of touches in active areas (e.g. buttons, text fields) versus touches in passive areas (areas without controls, thus without the need to be touched). A touch in a passive area can be the evidence of a stressed state as the user has most likely touched it while trying to touch an active area. Thus, the lower the accuracy is, the higher the contribution to the overall level of stress. Similarly we use the maximum value of the intensity of each touch. This is supported by the fact that touches performed by stressed users show a higher maximum value of intensity. Thus, the level of stress associated to this input is higher when the maximum intensity is higher.



(a) (b)

Fig. 6. Intensity of a touch over time (orange line) and corresponding quadratic curve (blue line) (a) and plot of calm (orange) and stressed (blue) touch patterns.

Finally we also perform an analysis of the acceleration sensed on the handheld device under the assumption that a stressed user will be more agitated, making more sudden movements, and this can be measured by the accelerometer. Nevertheless, a filter is applied to the accelerometer placed on the handheld device so that the variations of the acceleration that correspond to touches are removed (i.e. a variation in the acceleration is expected when we touch the device and this has no relation with level of stress). This way we make sure that the acceleration is an independent variable. Figure 7 shows two plots of the accelerometer data for the same time interval, with the raw data (a) and the data after applying the filter (b). The filtered data can thus be analyzed and contribute to the evaluation of the level of agitation, thus stress, of the user. Putting together all this information, the proposed monitoring framework is able to produce, in real-time, an estimation of the state of the user in terms of stress.



(a) (b)

Fig. 7. Information from the accelerometer corresponding to a user interacting with the touch screen (a) and the same information with the data corresponding to the touches filtered (b). The upper line represents the module of the acceleration while the three other lines represent acceleration in the three axes.

4 Conclusion and Future Work

Current trends in Online Dispute Resolution focus on developing tools that can help parties make contact and share information and proposals for problem resolution. This is expected to result in faster and more efficient conflict resolution processes. Moreover, virtual environments are being created that facilitate this interaction. However, the human side of conflict resolution is being left aside, as pointed out by the literature. Consequently, we must keep in mind that there is the risk of exclusion of important context information, considered vital by expert human mediators for making informed decisions, but unavailable in the online context. As a result, conflict resolution processes might ignore the human element and focus only on objective information, putting aside context information that may be quite important in order to perceive feedback from the parties and assess how they are being effected.

The approach presented has as its main objective the desire to enrich conflict resolution platforms by providing access to this kind of context information. Specifically, in this paper we focused on how to classify personal conflict resolution styles in an automated way and on estimating the level of stress of the users utilising non-invasive methods. This information can then be used by the platform or even by a mediator who is conducting the process, to perceive how each issue or event is effecting each party. This, we believe, will increase the success rate of conflict resolution procedures and bring ODR closer to the rich communicative environment that we have, when we communicate face-to-face.

Current research is now incorporating additional components that will contribute to the characterization of the stress, so that we can provide more acceptable advice. Namely, we are working on analyzing the patterns of movement of the users. This research is based on image processing. In a later phase, we intend to work with the School of Medical Sciences at University of Minho to use electroencephalograms that will be useful not only for validating this approach but also to more accurately calibrate it.

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