Emotional Interpretation of *Opera Seria*: Impact of Specifics of Drama Structure (Position Paper)

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Abstract: The application of artificial intelligence techniques to help musicologists analyse and classify operatic arias in terms of the sentiment they might be expressing constitutes a novel task that may benefit from the application of sentiment analysis techniques. However, because the analysis of text in this instance aims to provide information to support the analisis of the associated music, the conventions of how narrative is structured in traditional opera need to be taken into account to ensure that the relevant spans of text are considered. The present position paper argues for a treatment of operatic libretti as semi-structured data, to take advantage of annotations on speaker identity and recitative vs. aria distinctions so that the most relevant sentiment for the music of the arias can be mined from the texts. This would constitute a new task that applies artificial intelligence specifically to the needs of musicology.

1 INTRODUCTION

There is growing interest in exploring the application of artificial intelligence techniques to help musicologists analyse and classify operatic arias in terms of the sentiment they might be expressing. This has followed recent advances in the quality of sentiment analysis solutions. For a musicologist, being able to tell whether an aria might be expressing a particular sentiment opens the gate to identifying which of the musical features of the piece might be serving the purpose of expressing that sentiment (Torrente and Domínguez, 2022). However, in the particular context of opera, particularly *opera seria*, direct application of the procedures developed to attribute sentiment to news headlines or Twitter messages may not be the optimal approach, given the specific relations that hold between the sentiment expressed in an aria, the text of the aria, and the text of the recitative that has lead to the aria.

Opera seria is an Italian term used to describe the operatic genre that prevailed among the courts of Europe during most of the 18th century. It is characterised by the alternation of *recitative* – where the performers engage in dialogue that carries the action, sung in a style very close to normal speech and accompanied only by a limited subset of instruments – and *arias* – where solo singers elaborate on the feelings of a particular character and sing complex melodies accompanied by the whole orchestra (Fabbri, 2003). This convention was very strictly followed at the time.[1] The texts were always written in Italian, no matter the nationality of the composer or the country were they were performed.

The present position paper argues that this singular structure of *opera seria* needs to be considered when attempting automated treatment of the libretti to annotate the emotional content being expressed in the arias. The conventions of *opera seria* allow very complex dramatic situations to be set up during the longer recitatives, so that they can be given musical expression in the arias. But the arias themselves usually have very short texts, that very often express abstract or metaphoric references to the situation in question, rather than descriptions of them, because they rely for that on the material just presented in the preceding recitative. This presents a challenge to the artificial intelligence researcher attempting to run his sentiment

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[1]A brief review of evidence in support of this statement is provided in section 2.1 below.

analysis code on the text of the aria to obtain a meaningful representation of the feelings being expressed by the music of the aria. In the sections that follow we present a more elaborate argument in support of this point of view, and a simple computational experiment to show the significant differences in relative size between the volume of text of the arias and the volume of text of the recitatives that precede them.

2 PREVIOUS WORK

The following topics are reviewed: basic conventions of opera seria and existing work on identifying emotion in Italian opera.

2.1 Basics of Operatic Convention on Narrative

The chief structural principle of opera seria is the alternation of recitatives, where the plot action is expressed with simple music and accompaniment, and arias, where the characters express their feelings in elaborate musical settings with orchestra. This division, that may look artificial to a modern audience, appears to be a direct reflection of René Descartes' theory of human emotions as described in *Les passions de l'âme* (Descartes, 1649) doubtless the most influential essay on this matter for more than a century. Descartes uses the term passion to imply that human emotions are the reaction of the mind and the body to a certain action. As a consequence of this conception, the mechanics of opera seria consist of a sequence of actions during the recitatives that successively arouse specific passions in one or more characters that are in turn being expressed in their arias (Torrente and Llorens, 2020). For more than a century, arias followed the same structural pattern because 'form must be comprehensible if a work is to achieve its goal of moving the audience's passions' (Bonds, 1991, p. 81). The key to this separation is that the emotional conflicts expressed musically onstage in the form of arias are the "true" musical drama (Dahlhaus, 2003, p. 73). Usually, as the characters might be experiencing a set of complex emotions, a particular aria would attempt to represent a specific aspect of those feelings (Hill, 2005, p. 390). Operas were in fact a formal representation of an emotional universe (Bianconi, 2008, p. 85).

2.2 Mining Emotions in Opera

The recent work of Shibingfeng (Shibingfeng, 2021; Fernicola et al., 2020) addresses the automatic iden-

tification of emotion in Italian opera. This approach is based on the assumption that an aria may transmit more than one emotion, and to address this problem, the task is defined in terms of identifying the emotions transmitted by each specific stanza of the aria poem: in opera seria most poems consist of just two stanzas. To achieve this, a corpus of 2,500 aria stanzas was annotated by two human annotators with the emotions they attribute to it. A number of state-of-the-art text representations and classification approaches are tested over the corpus. Best performance was obtained by using a character trigram based TF-IDF representation and a neural network with 2 hidden layers as classifier. This yielded an accuracy of 0.47 on the test set. An extension of the work to assign emotions at the aria level, using a convolutional neural network combined with character trigram based embeddings developed based on a corpus of Italian arias achieved an accuracy of 0.68.

The annotated corpus of arias, the AriEmozione1.0 corpus, has been made public (Garcea et al., 2020).

3 RELATIVE DIFFERENCES IN EMOTIONAL INTERPRETATION CONTEXTS FOR ARIAS

The general idea is that, given that the libretto is an alternating sequence of spans of recitative followed by an aria, it would be useful to consider that the aria is intended to express the emotions felt by a particular character (the singer) as a result of the accumulated actions described in the preceding (span of) recitative.

This approach is made possible by the fact that libretti for opera seria are not single stretches of sequential text, but rather a sequence of small spans of text organised in a fixed structure of acts, scenes and contributions of individual singers at given points in time (Muñoz-Lago et al., 2020). The text of each of these small spans is itself broken down into lines of verse, though this feature does not influence the argument being put forward. The contributions by the singers are also annotated to show whether they are instances of recitative or of arias.

3.1 A Corpus of Machine-readable Operas

For the purpose of this paper, we are working with XML representations of all the libretti written by Pietro Metastasio, the principal li-

Table 1: A fragment of the libretto for the opera *Didone abandonata* as represented in XML. The fragment includes the first aria of the opera and some lines of the preceding recitative.

```
(...)
<speaker>DIDONE</speaker>
<l left-margin="12" n="80" type="r">
        Che?</l>
<speaker>ENEA</speaker>
<l left-margin="24" n="80" type="r">
        La patria, il cielo...</l>
<speaker>DIDONE</speaker>
<br/>
<l n="81" type="a">&amp;nbsp;&amp;nbsp;
        Parla.</l>
<br/>
<speaker>ENEA</speaker>
<br/>
<l left-margin="16" n="81" type="a">
        Dovrei... Ma no...</l>
<l n="82" type="a">
        L'amor... oh dio, la fé...</l>
<l n="83" type="a">
        Ah che parlar non so.</l>
<sp n="84" type="a">
<l n="84" type="a">
        Spiegalo tu per me. </l>
    <stage n="84">(Ad Osmida e parte)</stage>
</sp>
(...)
```

brettist in the eighteenth century,[2] that includes specific labels to identify the singers in each case (`<speaker>ENEA</speaker>`) and the specific lines (`<l n="82" type="a">`), indicating for each whether it corresponds to recitative (`type="r"`) or aria (`type="a"`). An example of a fragment of libretto is shown in Table 1.

3.2 Examples of Recitative-aria Pairings

The aria described in the previous section (Table 1) also serves as an example of the situation described to this point, where an aria of just 4 lines (81 to 84) follows the preceding 80 lines of recitative.

In this example, the text of the aria basically translates into "I should ... But no ... Love ... oh god, the faith ... Ah, what to talk about I don't know. You explain it for me."

This text hardly allows the reader to make out what the singer is feeling. Without the preceding 80 lines of recitative – which set out the situation at the start of the opera, with Enea arguing with Didone that,

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[2]Kindly provided by Anna Laura Bellina , director of the *Progetto Metastasio* at the University of Padova http://www.progettometastasio.it/.

Table 2: Example of an aria preceded by a recitative (*Didone abandonata*, Act I, Scene III). The original XML has been rendered as structured text for readability.

```
SCENA: SCENA III
[RECITATIVE]
(STAGE-DIRECTION): DIDONE, SELENE e OSMIDA
DIDONE:
85 Parte così, così mi lascia Enea?
86 Che vuol dir quel silenzio? In che son rea?
SELENE:
87 Ei pensa abbandonarti.
88 Contrastano quel core,
89 né so chi vincerà, gloria ed amore.
DIDONE:
90 È gloria abandonarmi?
OSMIDA:
91 (Si deluda). Regina,
92 il cor d'Enea non penetrò Selene.
93 Ei disse, è ver, che il suo dover lo sprona
94 a lasciar queste sponde
95 ma col dover la gelosia nasconde.
DIDONE:
96 Come!
OSMIDA:
96 Fra pochi istanti
97 dalla regia de' Mori
98 qui giunger dee l'ambasciador Arbace...
DIDONE:
99 Che perciò?
OSMIDA:
99 Le tue nozze
100 chiederà il re superbo e teme Enea
101 che tu ceda a la forza e a lui ti doni.
102 Perciò così partendo
103 fugge il dolor di rimirarti.
DIDONE:
103 Intendo.
104 S'inganna Enea ma piace
105 l'inganno all'alma mia.
106 So che nel nostro core
107 sempre la gelosia figlia è d'amore.
SELENE:
108 Anch'io lo so.
DIDONE:
108 Ma non lo sai per pruova.
OSMIDA:
109 (Così contro un rival l'altro mi giova).
DIDONE:
110 Vanne amata germana,
111 dal cor d'Enea sgombra i sospetti e digli
112 che a lui non mi torrà se non la morte.
SELENE:
113 (A questo ancor tu mi condanni, o sorte!)
[ARIA]
SELENE:
114 Dirò che fida sei,
115 su la mia fé riposa.
116 Sarò per te pietosa,
117 (per me crudel sarò).
118 Sapranno i labri miei
119 scoprirgli il tuo desio.
120 (Ma la mia pena, oh dio,
121 come nasconderò?)
(INDIVIDUAL-STAGE-DIRECTION):
(Parte)
```

in spite of this love for her, his destiny requires him to leave his confortable life with her and her love, and Didone objecting vehemently and arguing for the merit of a life of love beside her – it is quite impossible to understand how Enea is feeling at this point.

To further illustrate the argument, Table 2 shows a different fragment of the same opera, in which an aria is preceded by a short recitative. In this case, the text of the aria is slightly more expressive of the feelings of the singer at that point (Didone will not let someone else decide over her heart and fate), but the preceding recitative outlines the actions that have

triggered this response (her sister Selene has just told her that Enea leaves because he fears the hurt of seeing her accept the marriage proposal she has just received).

Table 3 shows a more complex and more convincing example of the case in question, taken from Metastasio's *Artaserse*. The scene involves the trial of Arbace, who is being falsely accused of murdering the Persian King Serse. The assigned judge is Artabano, Arbace's father, who is the one who actually killed Serse. Arbace knows that the real murderer is his father, but during the trial filial piety stops him not only from accusing his father, but also from defending himself, to the surprise of all. Artabano sentences his son to death for a murder that he himself has committed. At the end of the trial, Arbace pardons his father, kisses his hand, and sings the aria "Per quel paterno amplesso". The text of this aria speaks about his father's embrace and his own loyalty to the crown. The positive and even cheerful character of the poem does not reflect Arbace's inner feelings, having accepted his own sacrifice for a crime committed by his father. This cannot be grasped without taking into account the preceding recitative.

3.3 Reading Libretti onto Meaningful Data Structures

Fortunately the XML encoding allows very easily to recover the recitatives that precede a given aria. The main proposal of this position paper is that any emotional analysis of the content of an aria from the point of view of the text of the libretto – given that a major point of interest of such an analysis for musicology would be to identify which emotions might be represented in the corresponding musical fragment – should consider not just the text of the aria itself but also the text of the recitative that separates that aria from the preceding one.

The code for parsing the XML file of a libretto builds a representation in Java. The resulting Java classes are designed to capture the structure of nested conceptual elements that constitutes the libretto. The class diagram for this structure is shown in Figure 1 and explained below:

- `Libretto` class to represent a libretto for a full opera, made up of instances of `Atto` (this represents the complete opera)

- `Act` class to represent an act, made up of instances of `Scene` (these classes represent each of the acts in the opera)

- `Scene` class to represent a scene, made up of instances of `SceneUnit` (each act is broken down
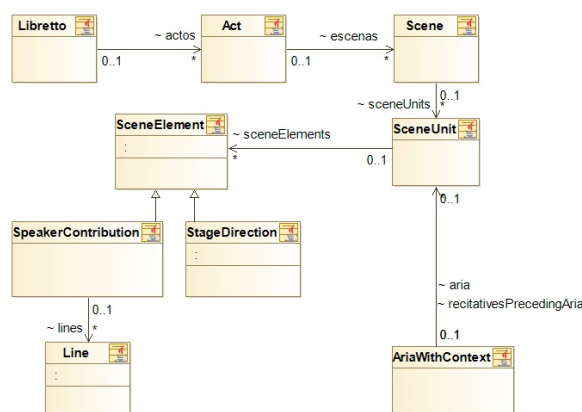

Figure 1: Class Diagram Representing the Nested Structure of Text Element in a Libretto.

into scenes, which are spans of the opera which usually involve the same subset of the cast)

- `SceneUnit` class to represent a fragment of a scene, that corresponds to either a recitative or an aria; made up of instances of `SceneElement` (with a scene, parts of it may be recitative and parts of it may be arias)

- `SceneElement` mother class for elements in a scene: speaker contributions or stage directions

- `StageDirection` extends `SceneElement` class to represent a stage direction (the libretto includes stage directions that are not spoken or sung but which are placed within the corresponding scene)

- `SpeakerContribution` extends `SceneElement` class to represent a contribution to a scene by a given speaker, made up of separate lines represented as instances of `Line` (recitatives in particular, but sometimes also ensemble arias – duets, trios –, are usually a sequence of alternating contributions by different speakers; this class represents a set of lines contributed to the scene by a given speaker without interruptions from other speakers)

- `Line` class to represent a line of verse (represented as a String) which may have an associated stage direction (also represented as a String)

- `AriaWithContext` class to represent the association between a `SceneUnit` class that represents the aria is associated with a `List<SceneUnit>` that represents the recitatives that precede it in the sequence of the opera

A given libretto can now be parsed into a seqeunce of instances of `AriaWithContext` class data structures, which allows easy retrieval of specific instances of an aria together with the recitatives that precede it.

Table 3: Example of an aria preceded by a recitative (*Artaserse*, Act II, Scene XI). The original XML has been rendered as structured text for readability. Some lines of the recitative not relevant to the point being made have been ommitted to match space constraints.

```
SCENA: SCENA XI
[RECITATIVE]
(STAGE-DIRECTION): ARBACE, con catene fra alcune
                        guardie, e detti

ARBACE:
980 Tanto in odio alla Persia
981 dunque son io che di mia rea fortuna
982 l'ingiustizie a mirar tutta s'aduna!
983 Mio re.

ARTASERSE:
983 Chiamami amico. Infin ch'io possa
984 dubitar del tuo fallo, esser lo voglio.
985 E perché sì bel nome
986 in un giudice è colpa, ad Artabano
987 il giudizio è commesso.

ARBACE:
987 Al padre!

ARTASERSE:
987 A lui.

ARBACE:
988 (Gelo d'orror).

ARTABANO:
988 Che pensi? Ammiri forse
989 la mia costanza?

ARBACE:
989 Inorridisco, o padre,
990 nel mirarti in quel luogo. E ripensando
991 quale io son, qual tu sei, come potesti
992 farti giudice mio? Come conservi
993 così intrepido il volto? E non ti senti
994 l'anima lacerar?

ARTABANO:
994 Quei moti interni,
995 ch'io provo in me, tu ricercar non devi
996 né quale intelligenza
997 abbia col volto il cor. Qualunque io sia
998 lo son per colpa tua. Se a' miei consigli
999 tu davi orecchio e seguitar sapevi
1000 l'orme d'un padre amante, in faccia a questi
1001 giudice non sarei, reo non saresti.

ARTASERSE:
1002 Misero genitor!

(...)

ARBACE:
1005 (Quanto rigor!)

ARTABANO:
1005 Dunque alle mie richieste
1006 risponda il reo. Tu comparisci, Arbace,
1007 di Serse l'uccisor. Ne sei convinto;
1008 ecco le prove. Un temerario amore,
1009 uno sdegno ribelle...

ARBACE:
1009 Il ferro, il sangue,
1010 il tempo, il luogo, il mio timor, la fuga
1011 so che la colpa mia fanno evidente.
1012 E pur vera non è, sono innocente.

ARTABANO:
1013 Dimostralo se puoi; placa lo sdegno
1014 dell'offesa Mandane.

ARBACE:
1014 Ah se mi vuoi
1015 costante nel soffrir, non assalirmi
1016 in sì tenera parte. Al nome amato
1017 barbaro genitor...

ARTABANO:
1017 Taci, e non vedi
1018 nella tua cieca intoleranza e stolta
1019 dove sei, con chi parli e chi t'ascolta?

ARBACE:
1020 Ma padre...

ARTABANO:
1020 (Affetti, ah tolerate il freno!)

(...)
```

```
ARTABANO:
1034 Principessa, è il tuo sdegno
1035 sprone alla mia virtù. Resti alla Persia
1036 nel rigor d'Artabano un grand'essempio
1037 di giustizia e di fé non visto ancora.
1038 Io condanno il mio figlio. Arbace mora.
(INDIVIDUAL-STAGE-DIRECTION):
(Sottoscrive il foglio)

(...)

ARTASERSE:
1039 Sospendi amico
1040 il decreto fatal.

ARTABANO:
1040 Segnato è il foglio,
1041 ho compito il dover.
(INDIVIDUAL-STAGE-DIRECTION):
(S'alza e dà il foglio ad Artaserse)

ARTASERSE:
1041 Barbaro vanto!
(INDIVIDUAL-STAGE-DIRECTION):
(Scende dal trono e i grandi si levano da sedere)

SEMIRA:
1042 Padre inumano!

(...)

ARTABANO:
1046 Di giudice severo
1047 adempite ho le parti. Ah si permetta
1048 agli affetti di padre
1049 uno sfogo o signor. Figlio perdona
1050 alla barbara legge
1051 d'un tiranno dover. Soffri, che poco
1052 ti rimane a soffrir. Non ti spaventi
1053 l'aspetto della pena; il mal peggiore
1054 è de' mali il timor.

ARBACE:
1054 Vacilla o padre
1055 la sofferenza mia. Trovarmi esposto
1056 in faccia al mondo intero
1057 in sembianza di reo, veder recise
1058 sul verdeggiar le mie speranze, estinti
1059 su l'aurora i miei dì, vedermi in odio
1060 alla Persia, all'amico, a lei che adoro,
1061 saper che il padre mio...
1062 Barbaro padre... (Ah, ch'io mi perdo!) Addio.
(INDIVIDUAL-STAGE-DIRECTION):
(In atto di partire, poi si ferma)

ARTABANO:
1063 (Io gelo).

(...)

ARBACE:
1063 O temerario Arbace,
1064 dove trascorri? Ah genitor, perdono.
1065 Eccomi a' piedi tuoi. Scusa i trasporti
1066 d'un insano dolor. Tutto il mio sangue
1067 si versi pur, non me ne lagno; e invece
1068 di chiamarla tiranna,
1069 io bacio quella man che mi condanna.

ARTABANO:
1070 Basta, sorgi, purtropo
1071 hai ragion di lagnarti;
1072 ma sappi... (Oh dei!) Prendi un abbraccio e parti.

ARBACE:

[ARIA]
ARBACE:
1073 Per quel paterno amplesso,
1074 per questo estremo addio,
1075 conservami te stesso,
1076 placami l'idol mio,
1077 difendimi il mio re.
1078 Vado a morir beato,
1079 se della Persia il fato
1080 tutto si sfoga in me.
(INDIVIDUAL-STAGE-DIRECTION):
(Parte fra le guardie seguito da Megabise e partono i grandi)
```

Table 4: Proportion of of poetic lines for arias to recitatives in Metastasio's libretti.

Title	% Arias	% Recitative
Didone abbandonata	16.15	83.85
Siroe	16.38	83.62
Catone in Utica	15.74	84.26
Ezio	12.78	87.22
Semiramide	18.49	81.51
Alessandro nell'Indie	16.64	83.36
Artaserse	16.48	83.52
Demetrio	16.54	83.46
Issipile	16.68	83.32
Adriano in Siria	16.69	83.31
Olimpiade	16.39	83.61
Demofoonte	15.21	84.79
La clemenza di Tito	15.98	84.02
Achille in Sciro	21.11	78.89
Ciro riconosciuto	13.99	86.01
Temistocle	14.97	85.03
Zenobia	13.75	86.25
Ipermestra	17.35	82.65
Antigono	18.34	81.66
Attilio Regolo	16.02	83.98
Il re pastore	16.49	83.51
L'eroe cinese	15.56	84.44
Nitteti	16.73	83.27
Il trionfo di Clelia	14.57	85.43
Romolo ed Ersilia	19.10	80.90
Ruggiero	12.47	87.53

Over such data structures, the text of the associated recitatives can now be easily processed to identify any emotional connotations that might be relevant for the emotional labelling of the aria.

3.4 Quantitative Data from the Corpus

Metastasio has 26 librettos with a total of 681 arias, including alternative arias that he wrote for some librettos and also the choirs; all that the Italians call *forme chiuse*, different from the *sciolti* verses of the recitative. The proportion of verses is 16% arias and 84% recitatives, although the range of arias oscillates between 12.5% and 21.1% for arias. The relative percentages of aria and recitatives with respect to the full length of the text is shown for the various libretti by Metastasio in Table 4.

To illustrate the point from a quantitative point of view, Table 5 shows the difference in volume of text – measured in terms of number of lines – between each of the arias and the recitative that precedes it for Metastasio's *Artaserse*. This table shows the significant differences between arias in the same text, with some cases where there is a very significant amount of recitative to be analysed to inform the emotions expressed in the aria that follows.

Table 5: Relative differences between the average sizes of each aria and the preceding span of recitative – expressed in number of lines – for Metastasio's *Didone abandonata* – left hand column – and *Artaserse* – right hand column.

Recitative	Aria	Recitative	Aria
178	5	103	7
33	8	36	8
96	6	66	6
31	7	38	8
29	8	56	8
7	6	11	12
71	8	196	7
25	8	13	8
33	7	3	6
3	6	49	12
134	8	12	10
66	12	52	10
18	10	83	12
16	9	84	8
44	10	48	8
37	8	50	9
3	8	8	9
95	8	222	8
29	8	30	8
9	7	24	12
51	6	18	6
33	9	6	9
5	8	0	4
169	8	61	10
8	9	5	7
55	7	67	8
6	8	6	8
101	6	37	10
22	8	6	6
6	8	198	16
0	3	163	6
115	8	56.5	8.6
73	8		
48	4		
48.5	7.6		

4 DISCUSSION

The emotion that the aria is expressing is not the result of its text exclusively, but rather of the narrative developments in the preceding recitative. The text of the aria is possibly intended as linguistic elaboration on the emotions in question, but the music is surely intended to represent the emotion felt by the character at that point in the drama, which is not necessarily clearly captured by the text of the aria. If it were, the whole point of opera as a genre would be put in question, as the dramatic recitatives leading to the aria, including all the dialogues between the characters and the development of the plot, would be dispensable.

The nature of opera libretti as documents subject to conventions on the need to indicate the overall structure of the drama – as a sequence of acts built of scenes – the specifics of verse sung by each performer – lines corresponding to a particular speaker – and even the type of contribution – either recitative or aria – allows this to be achieved with relative ease. The libretto of a particular opera can then be seen as semi-structured data, with these overarching annotations providing a complex structure that delivers spans of text at particular points, while providing with very specific details on their role in the context of the opera.

5 CONCLUSIONS

There is a fundamental difference between sentiment analysis of text as applied in other disciplines – such as news headlines or Twitter messages – and its potential application in musicology. Whereas for the analysis of news or items in a Twitter feed the text itself is the main and the only source of information, for the study of opera the text comes accompanied by an elaborate musical work which contributes at least as much as the text – and very possibly much more – to the emotions being expressed. When musicologists consider the emotions expressed in the text elements of an opera, it is not so much to obtain a single value that is the only source of information, but rather in search of additional information that may support their analyses of the emotion that the corresponding music is expressing.

The present paper argues that, in this endeavour, the text of the recitatives preceding an aria should be taken into consideration with special importance when trying to identify the emotions that (the music for) an aria should be considered to be trying to express.

This argument in no way intends to question the merit of application of sentiment analysis to the text of the arias themselves. Rather it proposes a slightly different task, possibly resorting to the same tools and techniques, but considering a slightly wider scope of text in their application to ensure that the best sources for emotional information are employed.

ACKNOWLEDGEMENTS

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