Automatic Music Performance Analysis and Comparison Toolkit

Johanna Devaney
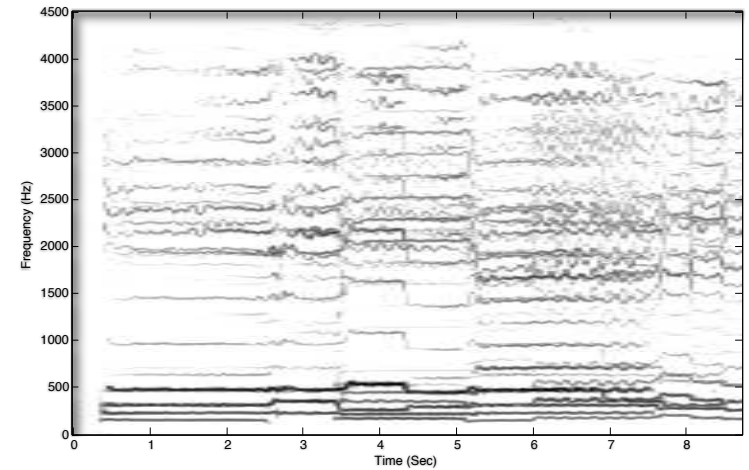

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Automatic Music Performance Analysis and Comparison Toolkit
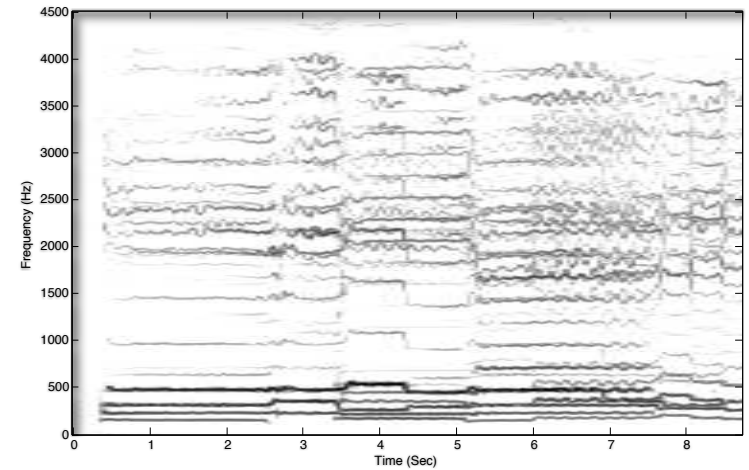
Johanna Devaney

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NATIONAL ENDOWMENT FOR THE
Humanities

Automatic Music Performance Analysis and Comparison Toolkit

Johanna Devaney

Alignment

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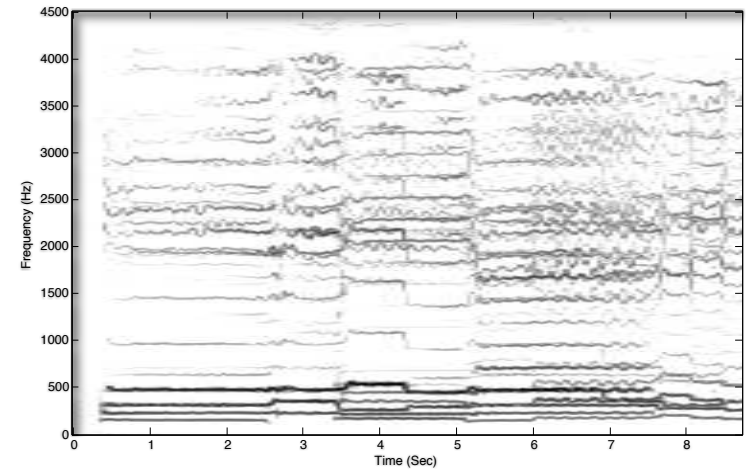
Automatic Music Performance Analysis and Comparison Toolkit

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Alignment

Note-wise f_0 estimations

Note-wise power estimations

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1
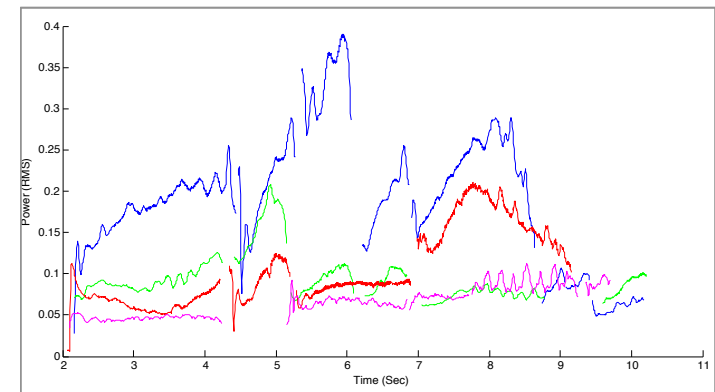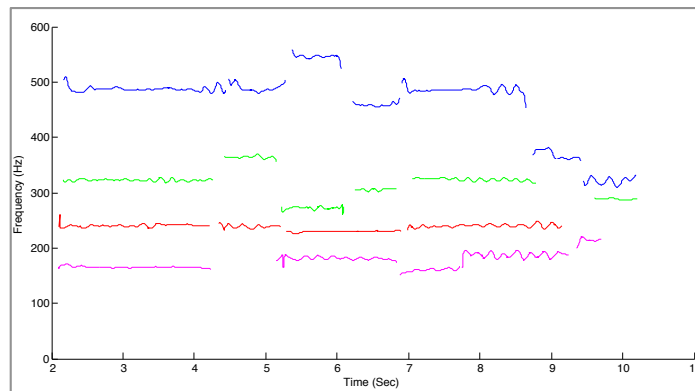
Note-wise summaries

Note-wise summaries

Timing: duration, inter-onset-interval

Note-wise summaries

Timing: duration, inter-onset-interval

Pitch: perceived pitch, vibrato rate and depth, jitter, slope and curvature of fundamental frequency

Note-wise summaries

Timing: duration, inter-onset-interval

Pitch: perceived pitch, vibrato rate and depth, jitter, slope and curvature of fundamental frequency

Perceived pitch

Note-wise summaries

Timing: duration, inter-onset-interval

Pitch: perceived pitch, vibrato rate and depth, jitter, slope and curvature of fundamental frequency

Note-wise summaries

Timing: duration, inter-onset-interval

Pitch: perceived pitch, vibrato rate and depth, jitter, slope and curvature of fundamental frequency

Perceived pitch

Vibrato Depth

Vibrato Rate

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Note-wise summaries

Timing: duration, inter-onset-interval

Pitch: perceived pitch, vibrato rate and depth, jitter, slope and curvature of fundamental frequency

Perceived pitch

Vibrato Depth

Vibrato Rate

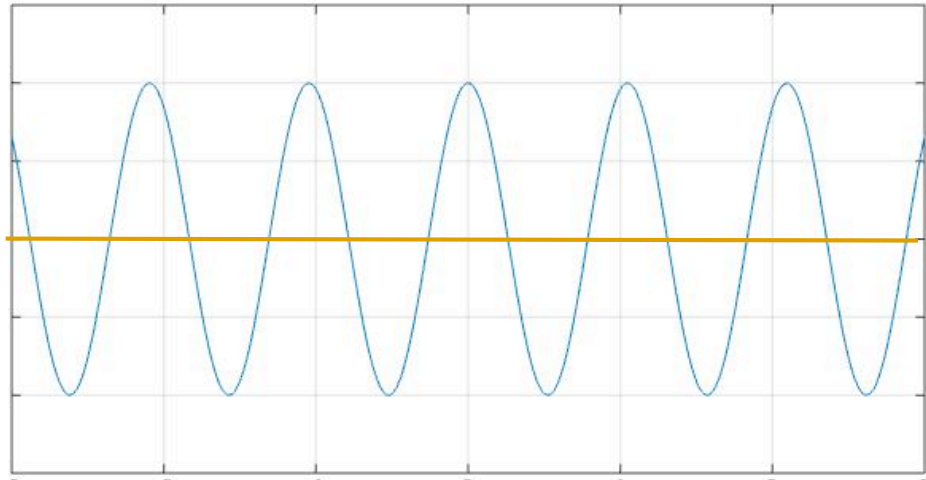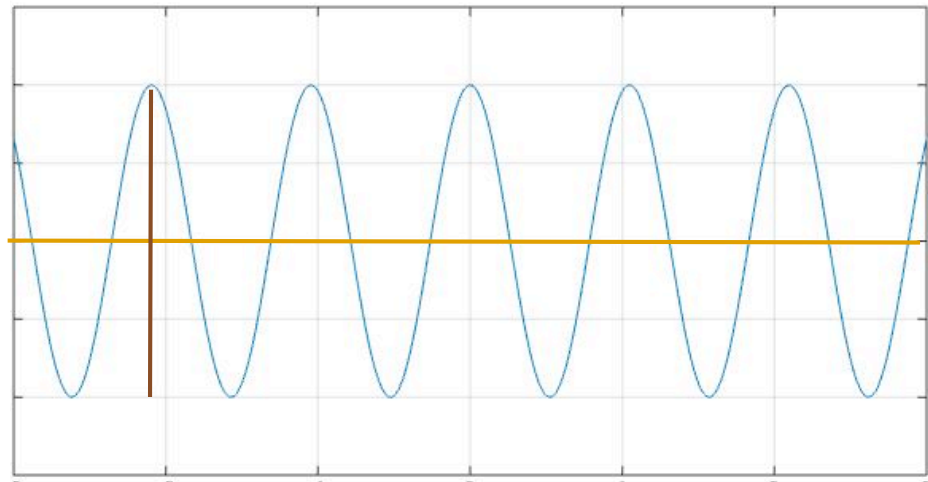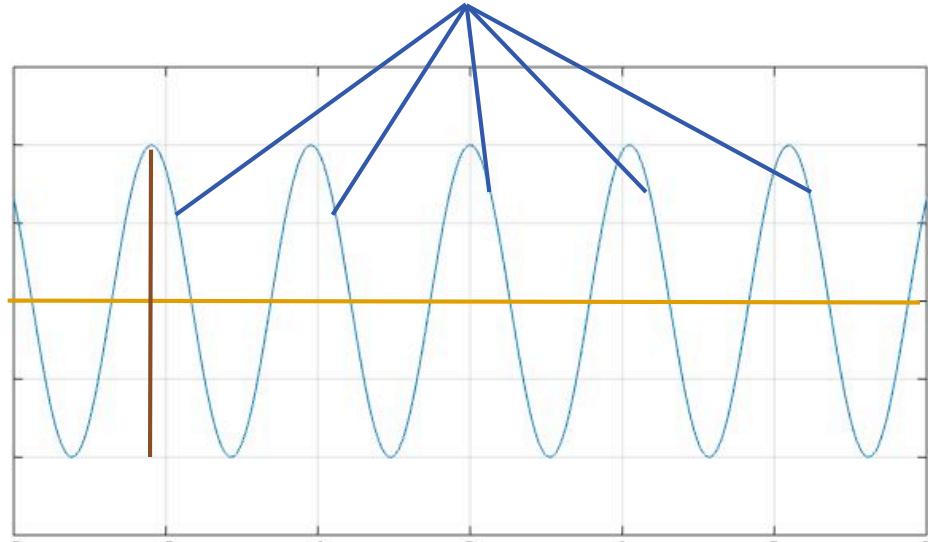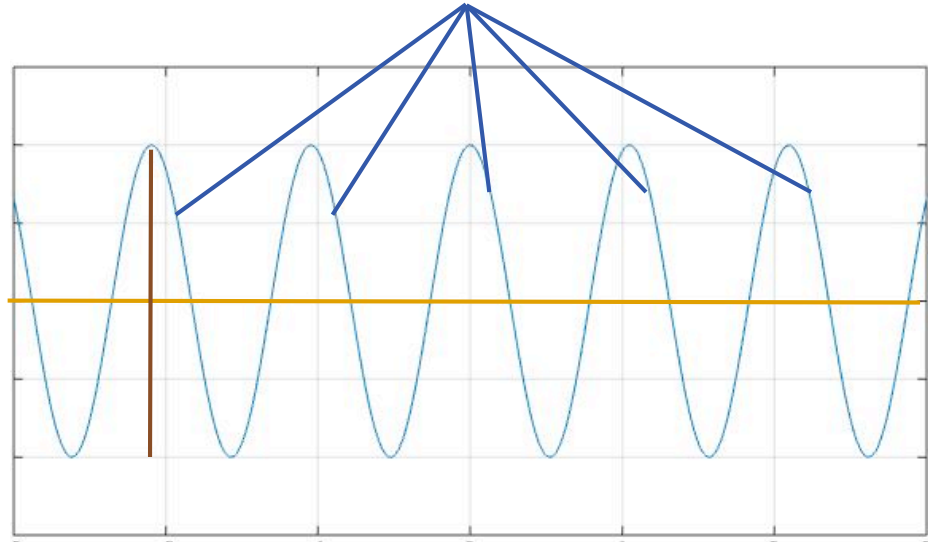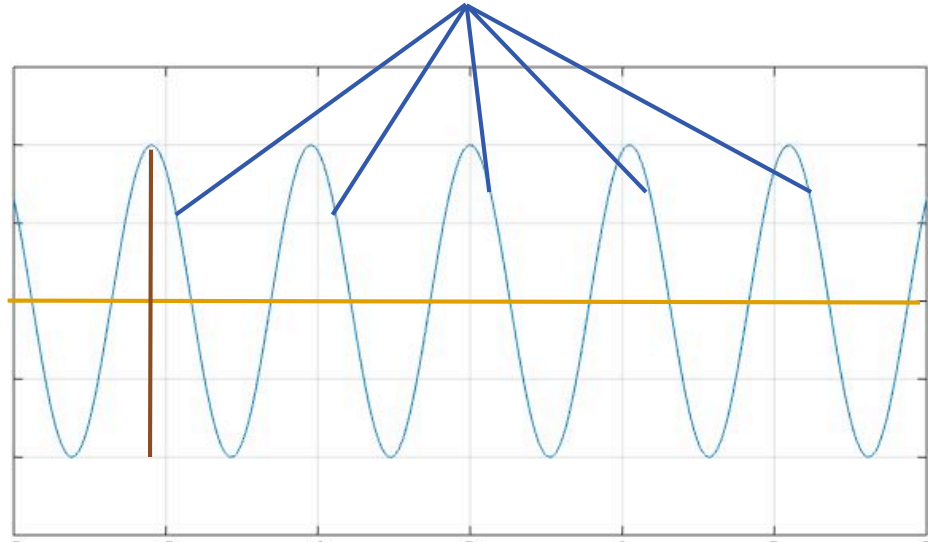**Loudness:** perceived loudness, shimmer

Note-wise summaries

Timing: duration, inter-onset-interval

Pitch: perceived pitch, vibrato rate and depth, jitter, slope and curvature of fundamental frequency

Perceived pitch

Vibrato Depth

Vibrato Rate

Loudness: perceived loudness, shimmer

Timbre: spectral centroid, slope, flatness, and flux, harmonics to noise ratio

```
!!!COM: Schubert, Franz Peter
!!!CDT: 1797-1828
!!!OTL: Ellens Gesang III ("Ave Maria")
!!!OPS: Opus 52
!!!ONM: No. 6
!!!SCT: D 839
!!Only first 3 mm. of the vocal part
```

**beat	**kern	**silbe	**rtstart	**rtdur	**freq	**slopeF0	**curveF0	**vibdepth	**vibrate	**jitter	**loudness	**shimmer	**specflat	**specslope	**specflux	**speccent	**hnr
*	*clefG2	*M4/4	*u=msec	*u=msec	*clefG2	*	*	*	*	*	*	*	*	*	*	*	*
*	*k[b-e-]	*	*MM60	*MM60	*k[b-e-]	*	*	*	*	*	*	*	*	*	*	*	*
*M4/4	*M4/4	*	*	*	*M4/4	*	*	*	*	*	*	*	*	*	*	*	*
*MM60	*MM60	*	*	*	*MM60	*	*	*	*	*	*	*	*	*	*	*	*
=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1
1	4.b-	A-	0	2900.5	456	-0.10373	-0.15858	27	4.5	0.3	23.484	18.8	0.06444	-0.00518	0.00089	0.02867	0.10361
2.5	16a	ve	2900.5	417.56	433	-0.053198	-0.09806	35	4.8	0.3	20.344	17.5	0.0703	-0.00516	0.001	0.02989	0.10961
2.75	16b-	Ma-	3406	484.86	460	-0.00041444	-0.093974	16	6.2	0.3	23.818	17.2	0.06633	-0.00518	0.001	0.02873	0.1223
3	4..dd	ri-	3901	3380.7	581	-0.030237	-0.11501	10	4.1	0.1	32.989	11	0.05972	-0.00517	0.00055	0.02913	0.13322
4.75	16cc	.	7344.9	319.25	508	0.026659	-0.0016503	10	3.1	0.1	20.321	10.5	0.05956	-0.00519	0.00067	0.02836	0.12893
=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2
1	4b-	a	7814.6	2116.3	455	0.0057001	0.27152	20	4.3	0.2	21.27	8.7	0.05987	-0.00518	0.00078	0.02897	0.12201
2	4r																
3	2r																
==	==	==	==	==	==	==	==	==	==	==	==	==	==	==	==	==	==

AMPACT

A - ve Ma - ri - - - a

```xml
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  <music>
    <body>
      <score>
        <scoreDef>
          meter.count="4"
          meter.unit="4"
          key.sig="2f" key.mode="major"
          clef.shape="G"
          clef.line="2"</scoreDef>
        <section>
          <staff n="1">
            <measure n="1">
              <note
                xml:id="note_1"
                tstamp="1"
                dur="4"
                dots="1"
                oct="4"
                pname="b"
                accid.ges="f"
                syl="A-"/>

            </measure>
          </staff>
        </section>
      </score>
      <performance>
        <recording>
          <avFile mimetype="audio/aiff" target="aveMaria.aiff"/>
            <when
              absolute="00:00:00.00"
              perf:offset="00:00:02.9005"
              perf:ioi="00:00:00.00"
              perf:duration="00:00:02.9005"
                perf:pitch="455.98"
                perf:slopeF0="-0.10373"
                perf:curvatureF0="-0.15858"
                perf:vibdepth="4.4811"
                perf:vibrate="26.911"
                perf:jitter="0.26913"
                perf:loudness="23.484"
                perf:shimmer="18.751"
                perf:specFlat="0.00088866"
                perf:specSlope="-0.0051845"
                perf:specCent="0.028675"
                perf:specFlux="0.00088866"
                perf:HNR="0.10361"
              perf:contF0="454.3737606    454.7165531    455.2337513    455.4622624    456.0605954 ..."
                perf:contPWR="0.000081059 0.00013102 0.00013133 0.00020036 0.00025492 ..."
                perf:contSpecFlat="0.18883 0.093385 0.06207 0.074795 0.058076 ..."
                perf:contSpecSlope="-0.0042241 -0.0049742 -0.0052679 -0.0051505    -0.0052442 ..."
                perf:contSpecCent="0.069648 0.037643 0.025114 0.030121 0.026127 ..."
                perf:contSpecFlux="0.063614 0.063614 0.027968 0.0035322 0.0019758 ..."
              perf:contHNR="0.079702 0.12358 0.054247    0.054466 0.099262 ..."
              xml:id="note_1"/>

        </recording>
      </performance>
    </body>
  </music>
</mei>
```

Encoding

!!Only first 3 mm. of the vocal part

**beat	**kern	**silbe	**rtstart	**rtdur	**freq	**slopeF0	**curveF0	**vibdepth	**vibrate	**jitter	**loudness	**shimmer	**specflat	**specslope	**specflux	**speccent	**hnr
*	*clefG2	*M4/4	*u=msec	*u=msec	*clefG2	*	*	*	*	*	*	*	*	*	*	*	*
*	*k[b-e-]	*	*MM60	*MM60	*k[b-e-]	*	*	*	*	*	*	*	*	*	*	*	*
*M4/4	*M4/4	*	*	*	*M4/4	*	*	*	*	*	*	*	*	*	*	*	*
*MM60	*MM60	*	*	*	*MM60	*	*	*	*	*	*	*	*	*	*	*	*
=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1
1	4.b-	A-	0	2900.5	456	-0.10373	-0.15858	27	4.5	0.3	23.484	18.8	0.06444	-0.00518	0.00089	0.02867	0.10361
2.5	16a	ve	2900.5	417.56	433	-0.053198	-0.09806	35	4.8	0.3	20.344	17.5	0.0703	-0.00516	0.001	0.02989	0.10961
2.75	16b-	Mari-	3406	484.86	460	-0.00041444	-0.093974	16	6.2	0.3	23.818	17.2	0.06633	-0.00518	0.001	0.02873	0.1223
3	4..dd	ri-	3901	3380.7	581	-0.030237	-0.11501	10	4.1	0.1	32.989	11	0.05972	-0.00517	0.00055	0.02913	0.13322
4.75	16cc	.	7344.9	319.25	508	0.026659	-0.0016503	10	3.1	0.1	20.321	10.5	0.05956	-0.00519	0.00067	0.02836	0.12893
=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2	=2
1	4b-	a	7814.6	2116.3	455	0.0057001	0.27152	20	4.3	0.2	21.27	8.7	0.05987	-0.00518	0.00078	0.02897	0.12201

**rtstart	**rtdur	**freq	**slopeF0	**curveF0	**vibdepth	**vibrate	**jitter	**loudness	**shimmer	**specflat	**specslope	**specflux	**speccent	**hnr
*u=msec	*u=msec	*clefG2	*	*	*	*	*	*	*	*	*	*	*	*
*MM60	*MM60	*k[b-e-]	*	*	*	*	*	*	*	*	*	*	*	*
*	*	*M4/4	*	*	*	*	*	*	*	*	*	*	*	*
*	*	*MM60	*	*	*	*	*	*	*	*	*	*	*	*
=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1	=1
0	2900.5	456	-0.10373	-0.15858	27	4.5	0.3	23.484	18.8	0.06444	-0.00518	0.00089	0.02867	0.10361

Humdrum

AMPACT

Timing Data
**rtstart
**rtdur

Loudness Data
**loudness
**shimmer

Pitch Data
**freq
**slopeF0
**curveF0
**vibdepth
**vibrate
**jitter

Timbre Data
**specflat
**specslope
**specflux
**speccent
**hnr

A - ve Ma - ri - - - a

```
                                key.sig="2" key.mode="major"
                                clef.shape="G"
                                clef.line="2"></scoreDef>
                <section>
                    <staff n="1">
                        <measure n="1">
                            <note
                                xml:id="note_1"
                                tstamp="1"
                                dur="4"
                                dots="1"
                                oct="4"
                                pname="b"
                                accid.ges="f"
                                syl="A-"/>
                        </measure>
                    </staff>
                </section>
            </score>
            <performance>
                <recording>
                    <avFile mimetype="audio/aiff" target="aveMaria.aiff"/>
                    <when
                        absolute="00:00:00.00"
                        perf:offset="00:00:02.9005"
                        perf:ioi="00:00:00.00"
                        perf:duration="00:00:02.9005"
                            perf:pitch="455.98"
                            perf:slopeF0="-0.10373"
                            perf:curvatureF0="-0.15858"
                            perf:vibdepth="4.4811"
                            perf:vibrate="26.911"
                            perf:jitter="0.26913"
                            perf:loudness="23.484"
                            perf:shimmer="18.751"
                            perf:specFlat="0.00088866"
                            perf:specSlope="-0.0051845"
                            perf:specCent="0.028675"
                            perf:specFlux="0.00088866"
                            perf:HNR="0.10361"
                        perf:contF0="454.3737606    454.7165531    455.2337513    455.4622624    456.0605954 ..."
                            perf:contPWR="0.000081059 0.00013102 0.00013133 0.00020036 0.00025492 ..."
                        perf:contSpecFlat="0.18883 0.093385 0.06207 0.074795 0.058076 ..."
                        perf:contSpecSlope="-0.0042241 -0.0049742 -0.0052679 -0.0051505    -0.0052442 ..."
                        perf:contSpecCent="0.069648 0.037643 0.025114 0.030121 0.026127 ..."
                            perf:contSpecFlux="0.063614 0.063614 0.027968 0.0035322 0.0019758 ..."
                        perf:contHNR="0.079702 0.12358 0.054247    0.054466 0.099262 ..."
                        xml:id="note_1"/>
                </recording>
            </performance>
        </body>
    </music>
</mei>
```

!!!COM: Schubert, Franz Peter
!!!CDT: 1797-1828
!!!OTL: Ellens Gesang III ("Ave Maria")
!!!OPS: Opus 52
!!!ONM: No. 6
!!!SCT: D 839
!!Only first 3 mm. of the vocal part
**beat   **kern   **silbe **rtstart **rt
*   *clefG2   *M4/4   *u=msec   *u=m
*   *k[b-e-] *   *MM60   *MM6
*M4/4   *M4/4   *   *   *
*MM60   *MM60   *   *   *
=1   =1   =1   =1   =1
1   4.b-   A-   0   2900
2.5   16a   ve   2900.5   417.
2.75   16b-   Ma-   3406   484.
3   4..dd   ri-   3901   3380
4.75   16cc   .   7344.9   319.
=2   =2   =2   =2   =2
1   4b-   a   7814.6   2116
2   4r
3   2r
==   ==   ==   ==   ==

perf:offset="00:00:02.9005"
perf:ioi="00:00:00.00"
perf:duration="00:00:02.9005"
        perf:pitch="455.98"
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        perf:curvatureF0="−0.15858"
        perf:vibdepth="4.4811"
        perf:vibrate="26.911"
        perf:jitter="0.26913"
        perf:loudness="23.484"
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        perf:specFlat="0.00088866"
        perf:specSlope="−0.0051845"
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        perf:HNR="0.10361"
perf:contF0="454.3737606   454.7165531   455.2337513   455.4622624   456.0605954 ..."
        perf:contPWR="0.000081059 0.00013102 0.00013133 0.00020036 0.00025492 ..."
perf:contSpecFlat="0.18883 0.093385 0.06207 0.074795 0.058076 ..."
perf:contSpecSlope="−0.0042241 −0.0049742 −0.0052679 −0.0051505   −0.0052442 ..."
perf:contSpecCent="0.069648 0.037643 0.025114 0.030121 0.026127 ..."
        perf:contSpecFlux="0.063614 0.063614 0.027968 0.0035322 0.0019758 ..."
perf:contHNR="0.079702 0.12358 0.054247   0.054466 0.099262 ..."

MEI

Timing Data
perf:offset
perf:ioi

Pitch Data
perf:pitch
perf:slopeF0
perf:curvatureF0
perf:vibdepth
perf:vibrate
perf:jitter
perf:loud
perf:contF0

Loudness Data
perf:loudness
perf:shimmer
perf:contPWR

Timbre Data
perf:specflat
perf:specslope
perf:specflux
perf:speccent
perf:hnr
perf:contSpecflat
perf:contSpecslope
perf:contSpecflux
perf:contSpeccent
perf:contHNR

AMPACT

A - ve Ma - ri - - - a

                xml:id="note_1"
                tstamp="1"
                dur="4"
                dots="1"
                oct="4"
                pname="b"
                accid.ges="f"
                syl="A-"/>
                        </measure>
                    </staff>
                </section>
        </score>
    <performance>
        <recording>
            <avFile mimetype="audio/aiff" target="aveMaria.aiff"/>
            <when
                absolute="00:00:00.00"
perf:offset="00:00:02.9005"
perf:ioi="00:00:00.00"
perf:duration="00:00:02.9005"
        perf:pitch="455.98"
        perf:slopeF0="−0.10373"
        perf:curvatureF0="−0.15858"
        perf:vibdepth="4.4811"
        perf:vibrate="26.911"
        perf:jitter="0.26913"
        perf:loudness="23.484"
        perf:shimmer="18.751"
        perf:specFlat="0.00088866"
        perf:specSlope="−0.0051845"
        perf:specCent="0.028675"
        perf:specFlux="0.00088866"
        perf:HNR="0.10361"
perf:contF0="454.3737606   454.7165531   455.2337513   455.4622624   456.0605954 ..."
        perf:contPWR="0.000081059 0.00013102 0.00013133 0.00020036 0.00025492 ..."
perf:contSpecFlat="0.18883 0.093385 0.06207 0.074795 0.058076 ..."
perf:contSpecSlope="−0.0042241 −0.0049742 −0.0052679 −0.0051505   −0.0052442 ..."
perf:contSpecCent="0.069648 0.037643 0.025114 0.030121 0.026127 ..."
        perf:contSpecFlux="0.063614 0.063614 0.027968 0.0035322 0.0019758 ..."
perf:contHNR="0.079702 0.12358 0.054247   0.054466 0.099262 ..."
xml:id="note_1"/>
        </recording>
    </performance>
        </body>
    </music>
</mei>

3

ALGORITHMS   **ENCODING FORMATS**   **DOCUMENTATION**   **DOWNLOADS**

ACKNOWLEDGEMENTS   **CONTACT**

Workshop at NYCDH Week

Introductory workshop to AMPACT, February 9th from 10am–12pm @ NYU. Reigster here.