#### Klaus A J Riederer, Dr. (tech), KAR Ltd, CEO: Seeing is believing: how to make OCR work in practice

WE HAVE JUST MOVED – WE ARE A FACTORY IN: Suurpellontie 1, FI-07700 Koskenkylän saha, Finland www.kar.fi kar@kar.fi KAR Oy Ab Ltd GmbH S.A.R.L

Valokuvavalmistamo KAR, Photography Production KAR, Bildtillverkning KAR, FotografieFertigung KAR, Photographie production KAR Taidevedostamo KAR, Fine Art Printmaking KAR, Konsttryckeri KAR, Kunstdruckwerk KAR, Imprimerie des Beaux-Arts KAR KAR Audio

#### -1. Lets make a poll!

Please answer truthfully by raising your hands:

- I. Who believes in free lunches?
- 2. Who believes in miracles?
- 3. Who believes everything must be **digitized**?
- 4. Who believes everything can be turned into bits (and pieces)?
- 5. Who has seen a proper OCR (optical character recognition) done in an automated fashion?

### o. take the FREE LUNCH!

- If somebody wants to offer you a free lunch, take it!
  - 2012 BAAC conference excursion to the Finnish Broadcasting Company (Yleisradio, YLE)



Library cabinets full of cardboards – YLE vinyl record archives









### o+1. I said: take the FREE LUNCH:

- If somebody wants to offer you a free lunch, take it!
  - We have 37 000 cardboards from our vinyl archives, ca. 1966 1973.
     Care to scan & OCR them, as nobody else cannot do it?





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They are, of course, all different (as such a computer would regard them)!

### 1. What do you want?

## What the customer wants? <u>Customer's initial specification</u>





- Take all the data out of the printed card
- Turn the data into information in XML format (for YLE's METRO database system)
   = structured information

### 2. What do you need?

- What the customer wants and (definitely) needs are not the same thing!
  - Do you really need all the data (even the obsolete, e.g. archive writer initials)





What are your minimum demands?



## **3.YLE OCR case: make a pilot!**

- The entrepreneur takes all the risks (bah!), so take the first 100 cards, scan & OCR them as a pilot!
  - But first, clean and tweak your machines









#### 4.YLE OCR case: make a test pilot!

 Testing one-two-three; alfa, beta, gamma; o-series – when does this "pilot" actually start?

 Scanning in 400 dpi (1:1), black-and-white uncompressed TIFs

. . .









#### **4.YLE OCR case: scanning**

Production scanning – show <u>video</u> or <u>photos</u>







#### 5. Optical character recognition (OCR)

- What is OCR?
- How does it work?
- How well does it work?
- How much does it cost?
- OCR many readymade (and less ready) solutions
  - Tesseract (open source, from HP originally)
  - Abbyy Finereader (many versions, also server-based)
  - Omnireader
  - Others..

#### What is the real problem here?

```
- 5
                                                                   + LPS 7.258
Ba 6.3
8d 5.3
             BRITTEN, Benjamin
Hb 1.3
Hb 1.32
Hb 1.35
              1-4. Folksong arrangements, vol.I: British Isles (Kansanlaulu-
                sovituksia Brittien saarilta)
    2145
1)2,3,4
              1. The Sally Gardens (n:o 1) (Rantapuistossa) .-
             2. The bonny earl o'Moray(n:o 3)(Morayn jaarli) .-
    2115
    2117
              3. The ash grove (n:o 6) (Saarnilehto) .-
             4. Oliver Cromwell (n:o 7) .-
    0137
             5-12. Winter words, op. 53, laulusarja Thomas Hardyn runoihin ja
5-12)
                balladeihin (Talvisia säkeitä) .- //
    19:53
              13-21. The Holy Sonnets of John Donne, op. 35, laulusarja.
13-21
   24.37
             Gilvan, Raimund (ten); Capon, Frederic (pf)
1,2) DA CAMERA SM 90002 ;
                            1966;
                                                esleht. ra + tks enq ;
                                                                        12 + 9 r
3,4) MUSICA RARA MUS 25
```

RK/ aa kpl 1,2,3,4 0K

6 pk + 6 ek + 16 syl = 35 pun, 10 val

#### What is the real problem here?

+LPS 7.262 (levypuoli 1)

KAR

OOPPERA-AARIOITA SAKSANKIELELLÄ

1) 1'22 1. Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin samppanja-aaria). - 2. Mozart: Don Giovanni: II: Doh vieni alla finestra (Don Giovannin serenadi). - 3. Mozart: Don Giovanni: 2) 1'45 II: Metà di voi qua vadano (Don Giovannin aaria). - 4. Mozart: 3) 2'55 Le Nozze di Figaro: III: Hai gia vinto la causa...Vedro, mentr'io sospiro (Kreivi Almavivan aaria). - 5. Beethoven: Fidelio: I: 4) 4'34 Ha! welch ein Augenblick! (Pizarron aaria). - 6. Verdi: Un ballo in maschera: I: Alla vita che t'arride (Renaton aaria). -5) 2'52 7. Verdi: Un ballo in maschera: III: Alzati!...Eri tu (Renaton resit: & aaria). - // 6) 2'35

F i s c h e r-D i e s k a u, Dietrich (bar); RSO Berlin (1-3); Berliner Philharmoniker (4); Bayerischea Staatsorchester (5); Orch. der Deutschen Oper Berlin (6); L ö w l e i n, Hans (joht-1-3); L e i t n e r, Ferdinand (4); F r i c s a y, Ferenc (joht-5); P a t a n e, Giuseppe (joht-6,7); Bayerischer Staatsopernchor (5).

RK/tp DGG SLPEM 136460;1964; kpl 1

7) 6'02

sel. sa takak.; 7 + (4)r 7pk+1ek = 15 pun 4 val

#### • What is the **real problem** here?

| 5                | + LPS 7.258  |                           | +LPS 7.262   |
|------------------|--|---------------------------|--|
| Ba 0.5           |  |                           | (levypuo <u>l</u> i 1)   |
| 80 2.3           |  |                           | O O P P E R A-A A R I O I T A S A K S A N K I E L E L L Ä  |
| Hb 1.3           | BRITTEN, Benjamin  |                           |  |
| Hb 1.32          |  | 1) 1'22                   | 1. Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin   |
| Hb 1.35          | 1-4. Folksong arrangements, vol.I: British Isles (Kansanlaulu-   |                           | samppania-aaria) 2. Mozart: Don Giovanni: II: Deh vieni alla   |
|                  | sovituksia Brittien saarilta)                                    | 2) 1'45                   | finestra (Don Giovannin serenadi), - 3. Mozart: Don Giovanni:  |
| 1) 2'45          | 1. The Sally Gardens (n:o_1) (Rantapuistossa)                    | -,                        | II. Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:  |
| 2) 215           | 2. The bonny earl o'Moray(n:o 3)(Morayn jaarli)                  | 3) 2155                   | Le Nozze di Figaro: III: Haj gia vinto la causa. Vedro, mentrio  |
| 3) 2117          | 3. The ash grove (n:o 6) (Saarnilehto)                           | 0, 200                    | sospiro (Kreivi Almaviyan aaria) 5. Beethoven: Fidelio: I.   |
| 4) 0' <i>3</i> 7 | 4. Oliver Cromwell (n:o 7)                                       | $(A)$ $(A^{\dagger})^{3}$ | Hal walch ain Augenblick! (Pizanon aaria) - 6 Verdi: Un ballo  |
| 5 101            | 5–12, Winter words, op. 53, laulusarja Thomas Hardyn runoihin ja |                           | in machena: I. Alla vita che tiannida (Renaton aaria)  |
| 0-121            | balladeihin (Talvisia sükeitä) //                                | 5) 2152                   | 7 Vender alle vita vita vita con e all'use (Renator all'all's e la contra de la con |
| 17 06            | 13-21. The Holy Sonnets of John Donne.op. 35. laulusaria.        | 57 2 52                   |  |
| 10-21            |  | 6) 2135                   |  |
| 244              |  | 0/ 2:50                   | E i a a h a a D i a a h a u Diataich (han), PSO Banlin (1-3),  |
|                  | GIIVan, Raimund (ten); Capon, Frederic (pt)                      | 7) 6102                   | Parling Deilegreiter (A). Deurigebes Stategeberter (197).  |
|                  |  | 7) 0.02                   | Der inter Philharmoniker (4); bayerischeg Staatsorchester (5);   |
| 4.01.01.01       |  |                           | 1. 2) L o i the per Derlin (0); L o will ell n, mans (jon-   |
| 1,2) DA CA       | MERA SM $90002$ ; 1966; esleht. $ra + tks eng$ ; $12 + 9 r$      |                           | 1-3); Leither, rerainand (4); Fridsay, rerend (jon-3);   |
| 3,4) MUSIC       | a rara mus 25 ;  |                           | Patane, Suseppe (jont-0,7); Bayerischer Staats-  |
|                  |  |                           | opernation (3).  |
|                  |  | 044                       |  |
| RK/ aa           | kp1 1,2,3,4 0K 6 $pk + 6 ek + 16 syl = 35 pun,$                  | KK/tp                     | UGG SLPEM 136460; 1964; sel. sa takak.; 7 + (4/r   |
|                  | 10 val   |                           | kp1 1 7pk+1ek = 15 pun 4 val   |

### o+1. I said: take the FREE LUNCH:

- If somebody wants to offer you a free lunch, take it!
  - We have 37 000 cardboards from our vinyl archives, ca. 1966 1973.
     Care to scan & OCR them, as nobody else cannot do it?





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They are, of course, **all different** (as such a computer would regard them)!

 Even without extensive knowledge about OCR, one can understand that
 OCR itself should not be the biggest problem

- Machine written text (special typewriter types of machines; 2 or 3 machines making slightly different typeface)
  - the <u>OCR should not be the major bottleneck</u>, at least when using well-trained (to the actual cards) & able
     OCR software

 OCR will always have problems that are inherent to the originals

- Some of the cards are pressed each other and/or otherwise worn (*bad condition originals*)
  - the OCR will make random mistakes there, no doubt about it (but their total amount is relatively small)
- Some of the cards include machine and/or hand-made corrections (e.g., double strikes; hand-written originals)
  - the OCR will make mistakes there, no doubt about it (but their <u>total amount</u> is small)

- But the layout in the cards is the PROBLEM
  - The information in the cards overlaps in visible rows, which is AREAL PROBLEM

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 AND the variance in the actual layout between the cards is

#### **EVEN MORE SERIOUS DILEMMA**

Technical vs. practical problems

| 5           |  |          |  |
|-------------|--|----------|--|
| Ra 6.3      | + LF3 7,2 10   |          | +LPS 7.262   |
| Bd 5.3      | · · · · · ·  |          | (levypuoli 1)  |
| Hh 1 3      | R R T T T F N . Reviamin   |          | OOPPERA-AARIOITA SAKSANKIELELLA  |
| Hb 1 32     |  | 4) 41.00 |  |
| Hb 1.35     | 1-4. Folksong arrangements vol I: British Teles (Kansanlaulu-    | 1) 1-22  | 1. Mozart: Don Glovarni: 1: Finch han dal vino (Don Glovarnin  |
| 10 1.00     | sovituksia Brittien saarilta)                                    | 0) 4145  | samppanja-aaria) 2. Mozart: Don Giovanni: II: Den Vieni alla   |
| 1) 2145     | 1. The Sally Gardens (n.o. 1) (Bantapuistossa)                   | 2) 1'45  | tinestra (Uon Giovannin serenadi) 3. Mozart: Uon Giovanni:   |
| 2) 2'15     | 2. The bonny earl of Moray (n: o 3) (Morayn jaarli) -            |          | 11: Meta di voi qua vadano (Uon diovannin aaria) 4. mozart:  |
| 3) 2117     | 3. The ash grove (n o 6) (Saarnilehto)                           | 3) 2.33  | Le Nozze di Figaro: 111: Hai gia vinto la causaVedro, mentr'io   |
| 4) 0137     | 4. Oliver Cromwell (n:o 7)                                       | A) A17A  | Sospiro (Kreivi Aimavivan aaria), - 3. beetnoven: Floeito: 1:  |
| E 401       | 5-12. Winter words, op. 53. laulusaria Thomas Hardyn runoihin ia | 4) 4.34  | ha: weich ein Augenolick; (Pizarron aarla) 0. Verol; Un ballo  |
| 5-12)       | balladeihin (Talvisia säkeitä) - //                              | 5) 2152  | 7 Vendia Un balla in prochama TTL Alasti Cai tu (Ponaton   |
| 20-00       | 13-21. The Holv Sonnets of John Donne.op. 35. laulusaria.        | 57 2.52  | 7. Verdi: Un ballo in maschera: III: Alzati:tri tu (nenaton  |
| 3-21        |  | 6) 2135  | resit; a adria) //   |
| 24.07       |  | 0) 2.30  | E i a a h a m D i a a k a u Diatrich (han), PSO Banlin (1-3),  |
|             | G I I V a n , Raimund (ten); Capon, Frederic (pt)                | 7) 6102  | Parlinger Deilberneriken (A). Prevenionebes Staatonebesten (5).  |
|             |  | 17 0 02  | Orah den Deutschen Onze Banlin (6): Läw Lein Hens (joht-   |
| 1 2) 04 044 |  |          | 1-3: Let $i$ the provide the formation $(A)$ : End $i$ and $(A)$ : End $(A)$ : Find $(A)$ : |
| Z AL MUSTCA | $\begin{array}{cccccccccccccccccccccccccccccccccccc$             |          | Patana Giusenna (inht-6 7) Bayerischer Stats-  |
| 3,41 MUSICA | rara mus zs ;  |          |  |
|             |  |          |  |
| DK / 22     | kn] 1 2 3 4 0K   | RK/to    | DGG S PEM 136460.1964. See   |
| ivit da     | $\phi p r + 0 \theta r + 10 sys = 30 p u n,$                     | nav up   | 70k+10k = 15  our  4  val  |
|             | 10 Vat   |          |  |

- The information in the cards overlaps in visible rows , which is A REAL PROBLEM
- AND the variance in the actual layout between the cards is EVEN MORE SERIOUS DILEMMA

#### 6. Standard OCR



Yes, OCR software can make OCR read areas (regions) of the scanned image

KAR

 but how well does it work?

#### 6. Standard OCR does

| Unitled document [2] - ABBYY FineReader 11 Corporate Edition   |  |  |  |  |  |  |
|--|--|--|--|--|--|--|
| ile Edit View Document Page Areas Tools Help   |  |  |  |  |  |  |
| 😕 🔲 🛄 🔀 Document language: 🚶 Exact Copy 🔽 🕾 Redo   |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |
| <pre> ************************************</pre>   | <pre></pre>  |  |  |  |  |  |
|  | Delete < Next >  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Yes, OCR software can make OCR read areas (regions) of the scanned image

KAR

 but how well does it work?

#### 6. Standard OCR does not



Yes, OCR software can make OCR read areas (regions) of the scanned Image

KAR

but how well does it work?

## 6. Standard OCR does not work



Yes, you can use in OCR software preset OCR read areas (regions)

KAR

 but what if all cards are different?

## 6. Standard OCR does not work!

| .X |               |  |
|----|---------------|--|
|    |               | +LPS 7.262<br>(levypuoli 1)<br>O O P P E R A-A A R I O I T A SAKSANKIELELLÄ  |
| 1) | 1' 22         | 1. Mozart: Don Giovasni: I: Finch' han dal vino (Don Giovannin   |
| 2) | 1 <b>'</b> 45 | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:   |
| 3) | 2155          | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io   |
| 4) | 4* 34         | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo  |
| 5) | 2'52          | 7. Verdi: Un ballo in maschera: III: Alzati!Eri tu (Renaton  |
| 6) | 2'35          | resit; & aaria/, $= //$  |
| 7) | 6102          | Berliner Philharmoniker (4); Bayerisches Staatsorchester (5);<br>Orch. der Deutschen Oper Berlin (6); L ö w I e i n, Hans (joht-<br>1-3); L e i t n e r, Ferdinand (4); F r i c s a y, Fereno (joht-5);<br>P a t a n e, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5). |
|    | RK/tp         | DGG SLPEM 136460;1964;<br>kpl 1 7pk+1ek = 15 pun 4 val   |

Do the region splitting manually per card?

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 And split your brains while doing it (37000\*8 = 296 000 regions)?!

## 7. PROBLEM – <del>what</del> how to do?

- Only one (obvious) solution here:
  - split the scanned image into regions and OCR those separately
  - HOW TO MAKE THIS EFFECTIVELY?

## 7. KAR Ltd. = problem solver

- KAR Ltd / Klaus A J Riederer, PhD: +20 years of coding – now applying also machine vision methods
  - Divide the scanned card image into 8 regions, applying deep intelligence mimicking human cognition
  - Each card is processed twice, both processes use multiple inter-dependent functioning levels

- The first run applies preset region positions (i.e., region of interest =ROI) for machine vision methods
  - Computer suggests the most probable region area for the user, based on numerous boundary conditions and preset rules
  - The machine vision methods and its conditions and rules are fine-tuned very carefully, separately for each region in question

- In the second run the user verifies and accepts or changes the region positions from the first run, because:
  - The computer "learns" from the user's response so that following regions' positions depend on the previous regions' positions (<= regions may not overlap!)</li>
    - This utilization of history is made only per current card, as the cards are so varying between each other
    - A global learning process is inherent in the coding process: the code has between iteratively improved (until ca. 15000 cards where run)

#### Divide the image into 8 position-varying regions

|          | G        |   | 1 discnro                            |
|----------|----------|---|--------------------------------------|
|          | •        |   | ("disc number")                      |
|          | e P      |   | 2 class                              |
| <b></b>  | q        | OUPPERA-AARIOITA SAKSANKIELELLA   | ("classification")                   |
| 1)       | 1'22     | 1. Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin<br>samppanja-aaria). – 2. Mozart: Don Giovanni: II: Deh vieni alla | 3 songlen                            |
| 2)       | 1' 45    | finestra (Don Giovannin serenadi). – 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria). – 4. Mozart:   | ("song length")                      |
| 3)       | 2'55     | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria) 5. Beethoven: Fidelio: I:      | 4 title ("disc title")               |
| •4)      | 4' 34 •  | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo   | 5 songname                           |
| 5)       | 2'52     | 7. Verdi: Un ballo in maschera: III: Alzati!Eri tu (Renaton resit: & aaria) //  | ("name per song")                    |
| 6)       | 2' 35    |   | = 6 artist                           |
| 7)       | 6'02     | F i s c h e r-D i e s k a u, Dietrich (bar); RSD Berlin (1-3);<br>Berliner Philharmoniker (4); Bayerischeg Staatsorchester (5);   | ("artist per disc")                  |
| <u> </u> | <u> </u> | 1-3; L e i t <sub>n</sub> e r, Ferdinand (4); F r i c s a y, Ferenc (joht-5);   | 7 publisher                          |
|          |          | Patane, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5).  | ("disc publisher")                   |
| ŀ        | RK/tp    | DGG SLPEM 136460;1964; sel. sa takak.; 7 + (4)r<br>kpl 1 7pk+1ek = 15 pun 4 val   | 8 addinfo ("additional information") |

#### Divide the image into 8 position-varying regions

|          | a <u> </u> | 72.62A   | 1 dischro              |
|----------|------------|--|------------------------|
|          | •          | 1 discnro  | ("disc number")        |
| , t      | d <u> </u> | (levypuoli 1)  | 2 class                |
| <b>a</b> |            | OOPPERA-AARIOITA SAKSANKIELELLÄ  | ("classification")     |
| 1)       | 1'22       | 1. Mozart: Don Giovanni: I: Fin <mark>ch' han dal vino (Don Giovannin samppanja-aaria). – 2. Mozart: Don Giovanni: II: Deh vieni alla</mark> | 3 songlen              |
| 2)       | 1' 45      | finestra (Don Giovannin serenadi). – 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria). – 4. Mozart:              | ("song length")        |
| 3)       | 2'55       | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria) 5. Beethoven: Fidelio: I:                 | 4 title ("disc title") |
| •4)      | 4' 34 •    | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo<br>in maschera: I: Alla vita che t'arride (Renaton aaria)                      | 5 songname             |
| 5)       | 2'52       | 7. Verdi: Un ballo in maschera: III: Alzati!Eri tu (Renaton  | ("name per song")      |
| 6)       | 2' 35      |  | 6 artist               |
| 7)       | 6'02       | F i s c h e r-D i e s k a u, Dietrich (bar); RSO Berlin (1-3);<br>Berliner Philharmoniker (4); Bayerischea Staatsorchester (5);              | ("artist per disc")    |
| d        |            | 0rch. der Deutschen Oper Berlin (6); L 8 w I e 1 n, Hans (joht-<br>1-3): L e i t n e r. Ferdinand (4): F r i c s a v. Ferenc (joht-5):       | 7 publisher            |
|          |            | Patane, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5).   | ("disc publisher")     |
| G        | RK/tp      | DGG SLPEM 136460; 1964; sel. sa takak.; 7 + (4)r   | 8 addinfo ("additional |
|          | -          | kpl 1 7pk+1ek = 15 pun 4 val   | information")          |

#### Divide the image into 8 position-varying regions

|         |            | 72.62A  | 1 discnro                            |
|---------|------------|---|--------------------------------------|
|         | 2 cla      |   | ("disc number")                      |
|         | d <u> </u> | +LPS 7.202<br>(levvpuoli 1)   | 2 class                              |
| <b></b> |            | OOPPERA-AARIOITA SAKSANKIELELLA   | ("classification")                   |
| 1)      | 1'22       | 1. Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin<br>samppanja-aaria) 2. Mozart: Don Giovanni: II: Deh vieni alla  | 3 songlen                            |
| 2)      | 1' 45      | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:       | ("song length")                      |
| 3)      | 2'55       | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria) 5. Beethoven: Fidelio: I:    | 4 title ("disc title")               |
| 4)      | 4' 34 '    | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo<br>in maschera: I: Alla vita che t'arride (Benaton aaria)         | 5 songname                           |
| 5)      | 2'52       | 7. Verdi: Un ballo in maschera: III: AlzatilEri tu (Renaton   | ("name per song")                    |
| 6)      | 2' 35      |   | 6 artist                             |
| 7)      | 6'02       | F i s c h e r-D i e s k a u, Dietrich (bar); RSO Berlin (1-3);<br>Berliner Philharmoniker (4); Bayerischeg Staatsorchester (5); | ("artist per disc")                  |
| d       |            | 1-3); L e i t n e r, Ferdinand (4); F r i c s a y, Ferenc (joht-5);   | 7 publisher                          |
|         |            | Patane, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5).  | ("disc publisher")                   |
|         | RK/tp      | DGG SLPEM 136460;1964; <b>Sel.</b> sa takak.; 7 + (4)r<br>kpl 1 7pk+1ek = 15 pun 4 val  | 8 addinfo ("additional information") |

#### Divide the image into 8 position-varying regions

|          | φ          |  | 1 discnro                            |
|----------|------------|--|--------------------------------------|
|          | <b>B</b>   |  | ("disc number")                      |
|          | - <b>-</b> | (levvpuoli 1)  | 2 class                              |
|          | Q          | OOPPERA-AARIOITA SAKSANKIELELLA  | ("classification")                   |
| Ď        | songl      | <b>CN1.</b> Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin<br>samppanja-aaria). – 2. Mozart: Don Giovanni: II: Deh vieni alla | 3 songlen                            |
| 2)       | 1' 45      | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:                  | ("song length")                      |
| 3)       | 2'55       | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria) 5. Beethoven: Fidelio: I:               | 4 title ("disc title")               |
| •4)      | 4'34 •     | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo<br>in maschera: I: Alla vita che tlarride (Renaton aaria) -                  | 5 songname                           |
| 5)       | 2'52       | 7. Verdi: Un ballo in maschera: III: AlzatilEri tu (Renaton  | ("name per song")                    |
| 6)       | 2'35       |  | 6 artist                             |
| 7)       | 6'02       | F i s c h e r-D i e s k a u, Dietrich (bar); RSO Berlin (1-3);<br>Berliner Philharmoniker (4); Bayerischeg Staatsorchester (5);            | ("artist per disc")                  |
| <u>ь</u> | d          | 1-3); L e i t n e r, Ferdinand (4); F r i c s a y, Ferenc (joht-5);  | 7 publisher                          |
|          |            | Patane, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5).   | ("disc publisher")                   |
|          | RK/tp      | DGG SLPEM 136460;1964; sel. sa takak.; 7 + (4)r<br>kpl 1 7pk+1ek = 15 pun 4 val  | 8 addinfo ("additional information") |

#### Divide the image into 8 position-varying regions

|          | <b>p</b> 0 |         | 72.62A  | 1 discnro              |
|----------|------------|---------|---|------------------------|
|          | •          | Φ       |   | ("disc number")        |
|          | le         |         | (levvpuoli 1)   | 2 class                |
| <b>F</b> |            | 4       | the PERA-AARIOITA SAKSANKIELELLÄ  | ("classification")     |
| 1)       | 1'22       |         | 1. Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin<br>samppanja-aaria). – 2. Mozart: Don Giovanni: II: Deh vieni alla           | 3 songlen              |
| 2)       | 1'45       |         | finestra (Don Giovannin serenadi). – 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria). – 4. Mozart:             | ("song length")        |
| 3)       | 2155       | C       | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria), - 5. Beethoven: Fidelio: I:             | 4 title ("disc title") |
| •4)      | 4'34       | ן       | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo   | 5 songname             |
| 5)       | 2'52       |         | in maschera: I: Alla vita che t'arride (Renaton aaria)<br>7. Verdi: Un ballo in maschera: III: Alzati!Eri tu (Renaton<br>resit: & aaria) // | ("name per song")      |
| 6)       | 2' 35      | )<br>ت  |   | = 6 artist             |
| 7)       | 6'02       |         | Fischer-Dieskau, Dietrich (bar); KSU Berlin (1-5);<br>Berliner Philharmoniker (4); Bayerisches Staatsorchester (5);                         | ("artist per disc")    |
| d        |            |         | 1-3): L e i t n e r. Ferdinand (4): F r i c s a y, Ferenc (joht-5);   | 7 publisher            |
|          |            |         | Patane, Giuseppe (joht-6,7); Bayerischer Staats-  | ("disc publisher")     |
| a        | RK/tp      | <u></u> | DGG SLPEM 136460; 1964; sel. sa takak.; 7 + (4)r  | 8 addinfo ("additional |
|          |            |         | kpl 1 7pk+1ek = 15 pun 4 val  | information")          |

#### Divide the image into 8 position-varying regions

|          | 2 0           | 72.62A  | 1 discnro                            |
|----------|---------------|---|--------------------------------------|
| ,        | Þ             |   | ("disc number")                      |
| t        | o             | +LPS 7.202<br>(levypuoli 1)   | 2 class                              |
| <b>f</b> |               | OOPPERA-AARIOITA SAKSANKIELELLÄ   | ("classification")                   |
| 1)       | 1'22          | 51. Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin<br>5. Sampania aria). – 2. Mozart: Don Giovanni: II: Deh vieni alla | 3 songlen                            |
| 2)       | 1'45          | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:           | ("song length")                      |
| 3)       | 2'55          | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria) 5. Beethoven: Fidelio: I:        | 4 title ("disc title")               |
| •4)      | 4'34          | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo   | 5 songname                           |
| 5)       | 2'52          | 7. Verdi: Un ballo in maschera: III: AlzatilEri tu (Renaton<br>resit: & aaria) //   | ("name per song")                    |
| 6)       | 2' 35         |   | 6 artist                             |
| 7)       | 6 <b>'</b> 02 | Berliner Philharmoniker (4); Bayerischeg Staatsorchester (5);   | ("artist per disc")                  |
| <u>а</u> |               | 1-3); L e i t n e r, Ferdinand (4); F r i c s a y, Ferenc (joht-5);   | 7 publisher                          |
|          |               | Patane, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5).  | ("disc publisher")                   |
| и        | RK/tp         | DGG SLPEM 136460;1964; sel. sa takak.; 7 + (4)r<br>kpl 1 7pk+1ek = 15 pun 4 val   | 8 addinfo ("additional information") |

#### Divide the image into 8 position-varying regions

|         | <b>p 0</b>  | 72.62A  | 1 discnro              |
|---------|-------------|---|------------------------|
| t.      | P           |   | ("disc number")        |
|         | g g         | (levypuoli 1)   | 2 class                |
| <b></b> | ą           | OOPPERA-AARIOITA SAKSANKIELELLA   | ("classification")     |
| 1)      | 1'22        | 1. Mozart: Don Giovarni: I: Finch' han dal vino (Don Giovarnin<br>samppanja-aaria). – 2. Mozart: Don Giovanni: II: Deh vieni alla | 3 songlen              |
| 2)      | 1'45        | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:         | ("song length")        |
| 3)      | 2'55        | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io  | 4 title ("disc title") |
| 4)      | 4' 34       | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo   | 5 songname             |
| 5)      | 2'52        | 7. Verdi: Un ballo in maschera: III: Alzati!Eri tu (Renaton   | ("name per song")      |
| 6)      | 2' 35       | resit; & daria), - //   | 6 artist               |
| 7)      | 6'02        | 6Fartsisth e r-D i e s k a u, Dietrich (bar); RSD Berlin (1-3);<br>Berliner Philharmoniker (4); Bayerisches Staatsorchester (5);  | ("artist per disc")    |
|         | <u>_</u>    | Orch. der Deutschen Oper Berlin (6); Löwlein, Hans (joht-<br>1-3): Leitner. Ferdinand (4): Fricsay, Ferenc (joht-5);              | 7 publisher            |
|         |             | Patane, Giuseppe (joht-6,7); Bayerischer Staats-  | ("disc publisher")     |
| 6       | RK/to       | DGG SLPEM 136460: 1964: sel, sa takaka: $7 + (4)r$  | 8 addinfo ("additional |
|         | <b>vi</b> v | kpl 1 7pk+1ek = 15 pun 4 val  | information")          |

#### Divide the image into 8 position-varying regions

|          |        |        | 72.62A  | 1 discnro              |
|----------|--------|--------|---|------------------------|
|          | T<br>T |        |   | ("disc number")        |
|          |        |        | (levypuoli 1)   | 2 class                |
| <b>-</b> |        | e      | OOPPERA-AARIOITA SAKSANKIELELLA   | ("classification")     |
| •        | 1) ·   | 1'22   | 1. Mozart: Don Giovasni: I: Finch' han dal vino (Don Giovannin<br>sampanja-aaria) 2. Mozart: Don Giovanni: II: Deh vieni alla   | 3 songlen              |
|          | 2)     | 1' 45  | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:       | ("song length")        |
|          | 3) :   | 2'55   | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria) 5. Beethoven: Fidelio: I:    | 4 title ("disc title") |
| •        | 4) 4   | 4'34 - | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo<br>in maschera: I: Alla vita che t'arride (Benaton aaria)         | 5 songname             |
| 1        | 5) :   | 2'52   | 7. Verdi: Un ballo in maschera: III: AlzatilEri tu (Renaton   | ("name per song")      |
| 1        | 6)     | 2' 35  |   | 6 artist               |
| •        | 7)     | 6'02   | F i s c h e r-D i e s k a u, Dietrich (bar); RSO Berlin (1-3);<br>Berliner Philharmoniker (4); Bayerischeg Staatsorchester (5); | ("artist per disc")    |
| ॑        |        | ee     | Orch. der Deutschen Oper Berlin (6); Löwlein, Hans (joht-<br>1-3): Leitner. Ferdinand (4): Fricsay. Ferenc (joht-5):            | 7 publisher            |
|          |        |        | Patane, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5).  | ("disc publisher")     |
|          | 7 🏚    | ubli   | Shedigg SLPEM 136460: 1964: $sel, sa takaka: 7 + (4)r$  | 8 addinfo ("additiona  |
|          |        |        | kpl 1 7pk+1ek = 15 pun 4 val  | information")          |

#### Divide the image into 8 position-varying regions

|         | a <del></del> | 72.62A  | 1 discnro              |
|---------|---------------|---|------------------------|
|         | P             |   | ("disc number")        |
|         | <br>œœ        | (levvpuoli 1)   | 2 class                |
| <b></b> |               | OOPPERA-AARIOITA SAKSANKIELELLA   | ("classification")     |
| 1)      | 1'22          | 1. Mozart: Don Giovarni: I: Finch' han dal vino (Don Giovarnin<br>samppanja-aaria). – 2. Mozart: Don Giovanni: II: Deh vieni alla | 3 songlen              |
| 2)      | 1' 45         | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:         | ("song length")        |
| 3)      | 2'55          | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kraivi Almavivan aaria) - 5 Beethoven: Fidelio: T.     | 4 title ("disc title") |
| •4)     | 4' 34         | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo   | 5 songname             |
| 5)      | 2152          | 7. Verdi: Un ballo in maschera: III: Alzati!Eri tu (Renaton   | ("name per song")      |
| 6)      | 2' 35         | resit; & aaria) //  | 6 artist               |
| 7)      | 6'02          | F i s c h e r-D i e s k a u, Dietrich (bar); RSO Berlin (1-3);<br>Berliner Philharmoniker (4); Bayerisches Staatsorchester (5);   | ("artist per disc")    |
| L       |               | Orch. der Deutschen Oper Berlin (6); Löwlein, Hans (joht-<br>1-3): Leitner, Ferdinand (4): Fricsav, Ferenc (joht-5);              | 7 publisher            |
|         |               | Patane, Giuseppe (joht-6,7); Bayerischer Staats-<br>opernchor (5).  | ("disc publisher")     |
| RK/tp   |               | DGG SLPEM 136460: 1964: 8 2018 8 2010 138 Fakek : 7 + (4)r  | 8 addinfo ("additiona  |
|         |               | kpl 1 7pk+1ek = 15 pun 4 val  | information")          |

- Most basic rules for the regions:
  - All the regions are rectangle –shaped
  - The card must have ONLY information from the region #1 (discnro), BUT other region information may be missing (= empty)

- Some of the region positions do not overlap; but
- The final region areas may overlap (so that all information is gathered from the cards, in cost of redundancy)

KAR

#### How does this work in practice?

|             |  | 72.62A  |  |  |
|-------------|--|---|--|--|
| e<br>D<br>e |  | +LPS 7.262 (levypuoli 1)  |  |  |
| <b>P</b>    | - <b></b>  | OOPPERA-AARIOITA SAKSANKIELELLÄ   |  |  |
| 1)          | 1'22   | 1. Mozart: Don Giovanni: I: Finch' han dal vino (Don Giovannin<br>samppanja-aaria). – 2. Mozart: Don Giovanni: II: Deh vieni alla |  |  |
| 2)          | 1'45   | finestra (Don Giovannin serenadi) 3. Mozart: Don Giovanni:<br>II: Metà di voi qua vadano (Don Giovannin aaria) 4. Mozart:         |  |  |
| 3)          | 2'55   | Le Nozze di Figaro: III: Hai gia vinto la causaVedro, mentr'io<br>sospiro (Kreivi Almavivan aaria) 5. Beethoven: Fidelio: I:      |  |  |
| •4)         | 4'34 •   | Ha! welch ein Augenblick! (Pizarron aaria) 6. Verdi: Un ballo<br>in maschera: I: Alla vita che t'arride (Renaton aaria)           |  |  |
| 5)          | 2'52   | 7. Verdi: Un ballo in maschera: III: Alzati!Eri tu (Renaton resit: & aaria) //  |  |  |
| 6)          | 2' 35  | Fischer-Dieskau. Dietrich (bar): RSO Berlin (1-3):  |  |  |
| 7)          | 6'02<br>Berliner Philharmoniker (4); Bayerisches Staatsorchester (5);<br>Orch. der Deutschen Oper Berlin (6); Löwlein, Hans (joht-<br>1-3); Leitner, Ferdinand (4); Fricsay, Ferenc (joht-5) |   |  |  |
| 3           |  | Patane, Giuseppe<br>opernchor (5). (joht-6,7); Bayerischer Staats-  |  |  |
| RK/tp       |  | DGG SLPEM 136460;1964; sel. sa takak.; 7 + (4)r<br>kpl 1 7pk+1ek = 15 pun 4 val   |  |  |

Too much between-card variation for 100 % automation

- not possible to automate the region splitting process fully.
- Numerous fine-tuned algorithms in the code -> runtime per card region splitting down to 15 – 30 s



#### Real-time demo of the semi-automated region creation (= cropping the scanned image into 8 subimages for OCR)



### 8. Improving the out-of-box OCR

KAR

Train the OCR (= teach character patterns using the actual scanned documents) or not?

| a 1.3 | i2 - |   | +LPS 6,00 |
|-------|------|---|-----------|
|       |      | Remember  |           |
| 2132  | 1.   | Irvina Berlin : Remember                              |           |
| 3'04  | 2.   | Fred E.Ahlert-Roy Turk : I'll get by (as long as I h  | ave vou)  |
| 2133  | 3.   | Irving Berlin : Always                                |           |
| 3100  | 4    | Johnny Mercer : Dream                                 |           |
| 2128  | 5.   | Gus Kahn-Isham Jones : It had to be you               |           |
| 2127  | Ē.   | Irving Kahal-Sammy Fain : I'll be seeing you //       |           |
| 2135  | 7.   | James van Heusen (san Sammy Cahn) : Look to your hea  | rt        |
| 2152  | 8    | Herman Huofeld : As time goes by                      | · •       |
| 3108  | 9.   | Axel Stordahl-Paul Weston(san Saway Calin) : Bay by d | av        |
| 2140  | 10.  | De Sviva-Brown-Henderson : Together                   |           |
| 2116  | 11   | Ray Noble : The very thought of you                   |           |
| 2138  | 12.  | Noel Coward : I'll see you again                      |           |
|       | Lu   | b o f f , Norman (kuoro eng ) , Lee, Bill (mi eng -4  | ,10)      |
| RCA   | vI   | ctor LPS-3400 . 1965 . 6+6r                           | -         |

#### 8. Tweak the OCR software!

- **Basic rules** set for the OCR software:
  - Only a limited set of languages allowed: English, Finnish, Frence, Germa, Latin, Spanish, Swedish

- All languages include the built-in dictionary and spell-check of the OCR software
- Additional Finnish words added to the dictionary.

#### 8. Tweak the OCR software!

Basic rules set for the OCR software (continued):

- Only a limited set of characters (ca. 89 pieces): !"&'()+,./0123456789:;=?ABCDEFGHIJKLMNOPQRSTUV WXYZabcdefghijklmnopqrstuvwxyzÄÜàáäåçèéöü
- Recognition area = the complete area inside the region (= the scanned & cropped image)
- **Output** as text files keeping line breaks, Unicode (UTF-8)

#### 8. Training the OCR?

#### Train the OCR or not?

| . 4 2  | o   |   | +LPS 6,001   |
|--|---|---|--|
| °81 [∌J  | 2   | Remember  |  |
| 2132<br>3104<br>2133<br>3100<br>2128<br>2127<br>2135<br>2152<br>3108<br>2140<br>2116<br>2138 | 1.<br>2.<br>3.<br>4.<br>5.<br>5.<br>7.<br>8.<br>9.<br>10.<br>11.<br>12. | Irving Berlin : Remember<br>Fred E.Ahlert-Roy Turk : I'll get by (as long<br>Irving Berlin : Always<br>Johnny Mercer : Dream<br>Gus Kahn-Isham Jones : It had to be you<br>Irving Kahal-Sammy Fain : I'll be seeing you<br>James van Heusen (san Sammy Cahn) : Look to y<br>Herman Hupfeld : As time goes by<br>Axel Stordahl-Paul Weston(san Sammy Cahn) : D<br>De Sylva-Brown-Henderson : Together<br>Ray Noble : The very thought of you<br>Noel Coward : I'll see you again | y as I have you)<br>//<br>your heart<br>Day by day |
|  | L u<br>T  | b o f f , Norman (kuoro eng ) , Lee, Bill (mi   | i eng <b>-4,</b> 10)                               |
| RCA<br>AH/   | AW  | stor LPS-3400, 1965 6+6r<br>kpl 1 12ek,   | 12nk,1Syl= 25 pun                                  |

### 8. Training the OCR?

#### Out-of-the box results of the OCR

ft

Fa 1.32

Remember

- 2r32 1, Irving Berlin ; Remember
- 3'04 2, Fred E.Ahlert-Roy Turk ; IfIl get by (as long as I have )
- 2'33 3, Irving Berlin : Always
- 3'00 4, Johnny Mercer ; Dream
- 2'28 5,Gus Kahn-Isham Jones : It had to be you
- 2'27 C, Irving Kahal-Sammy Fain : I'll beseeingyou//
- 2'35 7.James van Keusen (san Sarny Cahn): Looktoyour hea
- 2'52 8.Herman Hupfeld : As time goes by--
- 3fC8 9.Axel Stordahl-Paul Weston( san Sawwy -Ca<sup>n</sup>) : 6ay
- 2'40 10, De Sylva-6rown-Henderson ; Together
- 2M6 11eRay Noble : The very thought of you
- 2138 12.Noel Coward : I111 see you again

t u b o f f, Norman (kuoro eng), Lee, Bill (mi eng -4,10)

RCA Victor LPS-3400, 19654, 6t-6r AH/AW k^^-L

#### +LPS 6.001 Fa 1.32 Remember 2132 1. Irving Berlin : Remember 3'04 2. Fred E.Ahlert-Roy Turk : I'll get by (as long as I have you) 2133 3. Irving Berlin : Always 3100 4. Johnny Mercer : Dream 2128 5. Gus Kahn-Ishan Jones : It had to be you C. Irving Kahal-Sammy Fain : I'll be seeing you // 2127 7. James van Heusen (san Sammy Cahn) : Look to your heart 2135 8. Herman Hupfeld : As time goes by 2152 9. Axel Stordahl-Paul Weston(san Saway Calin) : Bay by day 3108 2'40 10. De Sylva-Brown-Henderson ; Together 2116 11, Ray Noble : The very thought of you 2138 12. Noel Coward ; I'll see you again L u b o f f, Norman (kuoro eng ), Lee, Bill (mi eng -4,10) RCA Victor LPS-3400 , 1965 6+6r 12ek\_12nk\_1Syl= 25 pun AH/AW kol 1 12ek,12nk,1Syl- 25 pun ( L -.J .-i--...1rii

KAR

4.PS 6/Xtt

#### 8. Training the OCR

#### Train the OCR or not (2)?

| Ba 2<br>Cd 6<br>Cd 5.2<br>Cb 1   | 1) +LP 7.702<br>2) +LPS 6.099 *.  |
|--|---|
| 1) 10'3(<br>2) 2'29<br>3'0'<br>3'36<br>2'04<br>71778<br>3) 4'09<br>4) 7130 | <ol> <li>Cessate, omai, kantaatti baritonille ja b c:lle. –</li> <li>Sonaatti e-molli sellolle ja b c:lle (Largo, Allegro, Largo, Allegro). – //</li> <li>La Senna festiggiante, "pastoraali-serenadi": II osa :<br/>Sinfonia (alkusoitto). –</li> <li>Piango, gemo, sospiro, kantaatti baritonille ja b c:lle. –</li> <li>Sonaatti c-molli viululle, sellolle ja b c:lle (Allegro, Largo, Allegro). –</li> </ol> |
| 4) / 50<br>5) 2'32<br>2'21<br>1'57<br>6'53                                 | M a l a g u t i, Laerte (bar- 1,4); R o v e d a, Egidio (vcl-2,4,<br>5); S c r o s o p p i, Antonio (vl- 5); S g r i z z i, Luciano<br>(cem - 2,4,5); Società Cameristica di Lugano'n orkesteri (ork-1,3)<br>L o e h r e r, Edwin (joht- 1,3)   |
| a den a steri  | 1) Nonesuch H 1098 ; saap, 1966 ; 5 + 5 r ; sel. eng ja tks it,eng<br>2) Nonesuch H 71088   |
| s./s.  | 1) kpl 1,2 0K<br>2) kpl 1,2   |

### 8. Training the OCR

#### Out-of-the box results of the OCR(2)

| f                                     |  |  |                |  |                |
|---------------------------------------|--|--|----------------|--|----------------|
| 1                                     |  |  |                |  |                |
| ZBa 2                                 |  |  |                | 1)A.P 7.702  |                |
| Cd 6                                  |  |  |                | 2)4L PS 6.099 V. I   |                |
| Cd 5.2                                | VIVALDI, Antonio   | 1  |                |  |                |
| Cb 1<br>1)10'30<br>2)2'29<br>3'01     | 1. Cessate; omai. kantaatti baritonille ja b c:lie<br>2. Sonaatti e-moili sellolle ja b c:lie (Largo, Allegro, Larqo,<br>Allegro) //   | Ba 2<br>Cd 6<br>Cd 5.2<br>Cb 1           |                | 1)       +LP 7.702         2)       +LPS 6.099         V I V A L D I, Antonio       -         1       Cessate omai         kantaatti haritonille ja h cille -  | ۲.             |
| 3'36<br>2'04+vr                       | 3.La Senna festiggiante, "pastoraali-serenadi": Il osa :<br>Sinfonia (alkusoitto)<br>4 Dianga gama, apopira, kantaatti baritanilla ja h oilla                                | 1) 10'3<br>2) 2'2<br>3'0                 | 0<br>9<br>1    | <ul> <li>2. Sonaatti e-molli sellolle ja b c:lle (Largo, Allegro, Largo Allegro) //</li> <li>3. La Senna festiggiante, "pastoraali-serenadi": II osa :</li> </ul>  | ,              |
| 3)4l09<br>4 7'30<br>' 5) 2'32         | 5.Sonaatti c-molli viululle, sellolle ja b c:lle (Allegro,<br>Largo, Allegro)  | 3' 3' 3' 3' 3' 3' 3' 3' 3' 3' 3' 3' 3' 3 | 6<br>4+vr<br>8 | Sinfonia (alkusoitto). –<br>4.Piango, gemo, sospiro, kantaatti baritonille ja b c:lle. –<br>5. Sonaatti c-molli viululle, sellolle ja b c:lle (Allegro,<br>Largo, Allegro). –  |                |
| 2'21<br>1'57+vr<br>I "TOJ<br>1        | Malaguti, Laerte (bar- 1,4) ; R o v e d a, Egidio (vol-2,4,<br>5);Scrosoppi. Antonio (vl- 5);Sgrizzi, Luciano<br>(cem - 2,4,5) ; Societa Cameristica di Lugano'n orkesteri ( | (ol 6'53                                 | +vr            | M a l a g u t i, Laerte (bar- 1,4); R o v e d a, Egidio (vcl-<br>5); S c r o s o p p i, Antonio (vl- 5); S g r i z z i, Lucia<br>(cem - 2,4,5); Società Cameristica di Lugano'n orkesteri (ork<br>L o e h r e r, Edwin (joht- 1,3) | 2,<br>no<br>-1 |
|                                       | L o e h r e r, Edwin (joht- 1,3)   | n<br>Ann<br>A                            | 1)<br>2)       | ) Nonesuch H 1098 ; saap, 1966 ; 5 + 5 r ; sel. eng ja tks it.en<br>2) Nonesuch H 71088  | 9              |
| 3<br>!1) Nonesuch H<br>2)Nonesuch H 7 | l 10S8 ; saap, 1966 ; 5 + 5 r ; sel. eng ja tks it,eng<br>71088takak.  | SL/SL                                    | 1)<br>2)       | 1) kpl 1,2 0K<br>2) kpl 1,2  |                |
| 1) kpl 1,2 OK5p                       | ok,8ek,5SvL-12pun,13val 5pk.8el  | κ.5S <sup>L</sup> - 12pι                 | un.13\         | <br>3val   |                |
| SL/SL 2)kpli;i.g<br>IJL               | <sup>y</sup> -l -1   | -,                                       | ,              |  |                |



- All first 100 cards (LPS6001-LPS6099) learned per all (desired) characters
- Most of the cards learned several times
- The used typeface ("font") in the cards is very problematic
  - Letters "i" and "I" and number "1" are VERY SIMILAR to each other,
  - Letters "o" and "O" and number "O" are VERY SIMILAR to each other
  - There are many other similarities as well hindering the OCR process!



Character templates (0-50) \* 89 + numerous ligatures, eg.:

11, 10, II, Ile, ie, ic, io, oc..

[capitalized: 11, 10, LL, LLE, IE, IC, IO, OC ..]

In total ca. 4000 specially taught patterns + built-in patterns used the OCR software.



#### Scanned image (with regions)

|  | ~   |   | +LPS 6,001   |
|--|---|---|--|
| a t <sub>e</sub> si  |   | Remember  |  |
| 2132<br>3104<br>2133<br>3100<br>2128<br>2127<br>2135<br>2152<br>3108<br>2140<br>2116<br>2138 | 1.<br>2.<br>3.<br>4.<br>5.<br>0.<br>7.<br>8.<br>9.<br>10.<br>11.<br>12. | Irving Berlin : Remember<br>Fred E.Ahlert-Roy Turk : I'll get by (as Long<br>Irving Berlin : Always<br>Johnny Mercer : Dream<br>Gus Kahn-Isham Jones : It had to be you<br>Irving Kahal-Sammy Fain : I'll be seeing you<br>James van Heusen (san Sammy Cahn) : Look to y<br>Herman Hupfeld : As time goes by<br>Axel Stordahl-Paul Weston(san Sammy Cahn) : I<br>De Sylva-Brown-Henderson : Together<br>Ray Noble : The very thought of you<br>Noel Coward : I'll see you again | g as I have you)<br>//<br>your heart<br>Bay by day |
|  | Lu  | b o f f , Norman (kuoro eng ) , Lee, Bill (m  | i eng -4,10)                                       |
| RCA<br>Ah/   | VI<br>'AW   | ctor LPS-3400, 1965 6+6r<br>kpl 1 12ek,   | 12nk,1Syl= 25 pun                                  |



ft



#### Untrained OCR's results

Remember

- 2r32 1, Irving Berlin ; Remember
- 3'04 2, Fred E.Ahlert-Roy Turk ; IfIl get by (as long as I have )
- 2'33 3, Irving Berlin : Always
- 3'00 4, Johnny Mercer ; Dream
- 2'28 5,Gus Kahn-Isham Jones : It had to be you
- 2'27 C, Irving Kahal-Sammy Fain : I'll beseeingyou//
- 2'35 7.James van Keusen (san Sarny Cahn): Looktoyour hea
- 2'52 8.Herman Hupfeld : As time goes by--
- 3fC8 9.Axel Stordahl-Paul Weston( san Sawwy -Ca<sup>n</sup>) : 6av
- 2'40 10, De Sylva-6rown-Henderson ; Together
- 2M6 11eRay Noble : The very thought of you
- 2138 12.Noel Coward : I111 see you again

t u b o f f, Norman (kuoro eng), Lee, Bill (mi eng -4,10)

RCA Victor LPS-3400, 19654, 6t-6r AH/AW k^^-L

+LPS 6-001 Fa 1.32 Remember 2132 1. Irving Berlin : Remember 3'04 2. Fred E.Ahlert-Roy Turk : I'll get by (as long as I have you) 2133 3. Irving Berlin : Always 3100 4. Johnny Mercer : Dream 5. Gus Kahn-Isham Jones : It had to be you 2128 C. Irving Kahal-Sammy Fain : I'll be seeing you // 2127 7. James van Heusen (san Sammy Cahn) : Look to your heart 2135 8. Herman Hupfeld : As time goes by 2152 9. Axel Stordahl-Paul Weston(san Saway Calin) ; Bay by day 3108 2'40 10. De Sylva-Brown-Henderson ; Together 2116 11. Ray Noble : The very thought of you 2138 12. Noel Coward ; I'll see you again L u b o f f, Norman (kuoro eng ), Lee, Bill (mi eng -4,10) RCA Victor LPS-3400 , 1965 6+6r 12ek\_12nk\_1Syl= 25 pun AH/AW kol 1 12ek,12nk,1Syl- 25 pun ( L -.1 .-i--...1rii

4.PS 6/Xtt



е

5

ft.



#### Fully trained OCR's results

| Fa | 1 | .32 |
|----|---|-----|
|----|---|-----|

Remember

- 2'32 1.Irving Berlin : Remember
- 3'04 2.Fred E.Ählert-Roy Turk : I'll get by (as long as I have you)
- 2'33 3. Irving Berlin : Always
- 3'00 4. Johnny Mercer : Dream
- 2'28 5.Gus Kahn-Isham Jones : It had to be you
- 2'27 G. Irving Kahal-Sammy Fain : I'll beseeingyou//
- 2'35 7.James van Heusen (san Sammy Cahn):Looktoyour heart
- 2'52 8.Herman Hupfeld : As time goes by--
- 3'08 9.Axel Stordahl-Paul WestonCsan Sammy Cahn) s Day by
- 2'40 10.De Sylva-8rcwn-Henderson ; Together
- 2'16 11.Ray Noble : The very thought of you
- 2'38 12.Noel Coward : I'll see you again

L u b o f f, Norman (kuoro eng), Lee, Bill (mi eng -4,10)

RCA Victor LPS-3400, 19654, 6+6r AH/AW

L^^-1.



Remember



#### Untrained vs. fully trained OCR's results

L -.1

#### 4 PS 6/Xtt Fa 1.32 Fa 1.32 Remember 2r32 2'32 1, Irving Berlin ; Remember 1.Irving Berlin : Remember 3'04 3'04 2,Fred E.Ahlert-Roy Turk ; IfIl get by (as long as I have you) 2.Fred E.Ählert-Roy Turk : I'll get by (as long as I have you) 2'33 2'33 3, Irving Berlin : Always 3.Irving Berlin : Always 3'00 3'00 4. Johnny Mercer : Dream 4. Johnny Mercer : Dream 2'28 2'28 5.Gus Kahn-Isham Jones : It had to be you 5.Gus Kahn-Isham Jones : It had to be you 2'27 2'27 C, Irving Kahal-Sammy Fain : I'll beseeingyou// G. Irving Kahal-Sammy Fain : I'll beseeingyou// 2'35 2'35 7.James van Keusen (san Sarnv Cahn): Looktovour heart 7.James van Heusen (san Sammy Cahn):Looktoyour heart 2'52 2'52 8.Herman Hupfeld : As time goes by--8.Herman Hupfeld : As time goes by--3fC8 3'08 9.Axel Stordahl-Paul Weston( san Sawwy -Ca<sup>-n</sup> ) : 6ay by day. 9.Axel Stordahl-Paul WestonCsan Sammy Cahn) s Day by day. 2'40 2'40 10.De Sylva-6rown-Henderson : Together 10.De Sylva-8rcwn-Henderson : Together 2M6 2'16 11eRay Noble : The very thought of you 11.Ray Noble : The very thought of you 2138 2'38 12.Noel Coward : I111 see you again 12.Noel Coward : I'll see you again t u b o f f, Norman (kuoro eng), Lee, Bill (mi eng -4,10) L u b o f f, Norman (kuoro eng.), Lee, Bill (mi eng.-4,10) RCA Victor LPS-3400, 19654, 6t-6r RCA Victor LPS-3400, 19654, 6+6r е AH/AW AH/AW 5 k^^-L L^^-1. ft. 12ek,12nk,1Syl- 25 pun (

.-i--...1rii

| -1  | DC                  | e  | $\Omega \Omega $ | 1 |
|-----|---------------------|----|------------------|---|
| - 1 | <b>E</b> \ <b>D</b> | 53 |                  |   |

е

5

ft

f

.-i--...1rii

12ek,12nk,1Syl- 25 pun (

L - J



#### Scanned image (with regions) (2)

| Ba 2   | 1) +LP 7,702  |
|--|---|
| Cd 6<br>Cd 5.2<br>Cb 1   | VIVALDI, Antonio  |
| 1) 10'30<br>2) 2'29<br>3'01<br>3'36<br>2'04<br>71778<br>3) 4'09<br>4) 7130 | <ul> <li>1. Cessate, omai, kantaatti baritonille ja b c:lle. –</li> <li>2. Sonaatti e-molli sellolle ja b c:lle (Largo, Allegro, Largo, Allegro). – //</li> <li>3. La Senna festiggiante, "pastoraali-serenadi": II osa :<br/>Sinfonia (alkusoitto). –</li> <li>4.Piango, gemo, sospiro, kantaatti baritonille ja b c:lle. –</li> <li>5. Sonaatti c-molli viululle, sellolle ja b c:lle (Allegro, Largo, Allegro). –</li> </ul> |
| 5) 2'32<br>2'21<br><u>1'57</u> +<br>6'53                                   | Malaguti, Laerte (bar-1,4); Roveda, Egidio (vcl-2,4,<br>5); Scrosoppi, Antonio (vl-5); Sgrizzi, Luciano<br>(cem - 2,4,5); Società Cameristica di Lugano'n orkesteri (ork-1,3)<br>Loehrer, Edwin (joht-1,3)  |
| 9<br>  | 1) Nonesuch H 1098 ; saap, 1966 ; 5 + 5 r ; sel. eng ja tks it,eng<br>2) Nonesuch H 71088   |
| sl/sl  | 1) kpl 1,2 0K<br>2) kpl 1,2   |



#### Untrained OCR's results

f /

| ,   |   |   | 1)A P 7 702   |
|---|---|---|---|
| ZBa 2   |   |   | 2)/1 PS 6 000 y i   |
| Cd 6  |   |   | 2)4L F3 0.099 V. I  |
| Cd 5.2  | VIVALDI, Antonio  | 1   |   |
| Cd 5.2<br>Cb 1<br>1)10'30<br>2)2'29<br>3'01<br>3'36<br>2'04+vr<br>3)4l09<br>4 7'30<br>' 5) 2'32 | <ol> <li>Cessate; omai. kantaatti baritonille ja b c:lie</li> <li>Sonaatti e-moili sellolle ja b c:lie (Largo, Allegro, Larqo, Allegro) //</li> <li>La Senna festiggiante, "pastoraali-serenadi": II osa :<br/>Sinfonia (alkusoitto)</li> <li>Piango.gemo, sospiro, kantaatti baritonille ja b c:lle</li> <li>Sonaatti c-molli viululle, sellolle ja b c:lle (Allegro, Largo, Allegro)</li> </ol> | Ba 2<br>Cd 6<br>Cd 5.2<br>Cb 1<br>1) 10' 30<br>2) 2' 29<br>3' 01<br>3' 36<br>2' 04+<br>TTT 18<br>3) 4' 09<br>4) 7' 30   | <ul> <li>1) +LP 7.702<br/>2) +LPS 6.099 +LPS 6.</li></ul> |
| 1'57+vr<br>I "TOJ<br>1  | Malaguti, Laerte (bar- 1,4) ; R o v e d a, Egidio (vol-2,4,<br>5);Scrosoppi. Antonio (vl- 5);Sgrizzi, Luciano<br>(cem - 2,4,5) ; Societa Cameristica di Lugano'n orkesteri (o<br>L o e h r e r, Edwin (joht- 1,3)   | 2'21<br>2'21<br>1'57+v<br>6'53  | <ul> <li>Malaguti, Laerte (bar-1,4); Koveda, Egidio (vci-2</li> <li>5); Scrosoppi, Antonio (vi-5); Sgrizzi, Luciani<br/>(cem - 2,4,5); Società Cameristica di Lugano'n orkesteri (ork-<br/>Loehrer, Edwin (joht-1,3)</li> <li>1) Nonesuch H 1098; saap, 1966; 5+5r; sel. eng ja tks it.eng<br/>takak</li> </ul>   |
| 3   |   | and the second se | Survey  |
| 1) Nonesuch I   | H 10S8 ; saap, 1966 ; 5 + 5 r ; sel. eng ja tks it,eng<br>71088takak  | s./s.   | 1) kpl 1,2 0K<br>2) kpl 1,2   |
| 1) kpl 1,2 OK5<br>SL/SL 2)kpli;i.g  | pk,8ek,5SvL-12pun,13val 5pk,8ek,4<br>g <sup>_y</sup> -l -1  | 1<br>5S <sup>L</sup> - 12pun  | un,13val  |



#### Fully trained OCR's results

f /

70- 2

|   |   |  | 2)+LPS 6.099 v. i   |
|---|---|--|---|
| Cd 5.2                                  | VIVALDI, Antonio  | <i>i</i>   |   |
| Cb 1<br>1)10'30<br>2)2'29               | 1. Cessate, omai, kantaatti baritonille ja b c:lie<br>2. Sonaatti e-rnolli sellolle ja b c:lie (Largo, Allegro, Largo,  | Ba 2<br>Gd 6<br>Gd 5.2<br>Cb 1                                   | 1) +LP 7.702<br>2) +LPS 6.099 +-  |
| 3'01<br>3'36<br>2'04+vr                 | Allegro) //<br>3.La Senna festiggiante, "pastoraali-serenadi": II osa :<br>Sinfonia (alkusoitto)<br>4 Piango gemo, sospiro, kantaatti baritopille ja bicilje, -                       | 1) 10' 30<br>2) 2' 29<br>3' 01<br>3' 36                          | <ol> <li>Cessate, omai, kantaatti baritonille ja b c:lle. –</li> <li>Sonaatti e-molli sellolle ja b c:lle (Largo, Allegro, Largo,<br/>Allegro). – //</li> <li>La Senna festiggiante, "pastoraali-serenadi": II osa :<br/>Sinforia (alkunaitta)</li> </ol> |
| 4 7' 30<br>5) 2'32                      | 5.Sonaatti c-molli viululle, sellolle ja b c:lie (Allegro,<br>Largo, Allegro)   | 2'04+vr<br>71718<br>3) 4'09<br>4) 7'30                           | 4.Piango, gemo, sospiro, kantaatti baritonille ja b c:lle. –<br>5. Sonaatti c-molli viululle, sellolle ja b c:lle (Allegro,<br>Largo, Allegro). –   |
| 221<br>1'57+vr<br>I "ra<br>1            | Malaguti, Laerte (bar- 1,4) ; R o v e d a, Egidio (vcl-2,4,<br>5); S e r o s o p p i. Antonio (vl- 5);Sgrizzi, Luciano<br>(cem - 2,4,5) ; Società Cameristica di Lugano'n orkesteri ( | 5) $2^{1}3^{2}$<br>$2^{1}2^{1}$<br>$1^{1}57+vr$<br>$0$ $6^{1}53$ | M a l a g u t i, Laerte (bar- 1,4); R o v e d a, Egidio (vcl-2,<br>5); S c r o s o p p i, Antonio (vl- 5); S g r i z z i, Luciano<br>(cem - 2,4,5); Società Cameristica di Lugano'n orkesteri (ork-1<br>L o e h r e r, Edwin (joht- 1,3)                  |
| '<br>-                                  | L o e h r e r, Edwin (joht- 1,3)  | 1  | ) Nonesuch H 1098 ; saap, 1966 ; 5 + 5 r ; sel. eng ja tks it.eng<br>2) Nonesuch H 71088 takak.   |
| 3<br>!1) NonesuchH<br>2)NonesuchH7      | l10S8 ;saap, 1966 ; 5 + 5 r ; sel. eng ja tksit,eng<br>'1088takak.  | sl/sl 2  | 2) kpl 1,2 0K<br>2) kpl 1,2<br>1,2  |
| 1) kpl 1,2 OK5j<br>SL/SL2)kpll'2<br>IJL | pk,8ek,5SyL-12pun,13val 5pk,8ek<br>-1   | ,5S <sup>L</sup> - 12pun,1                                       | 3val  |

1)+LP 7.702



#### Untrained vs. fully trained OCR's results

| f<br>/<br>ZBa 2<br>Cd 6<br>Cd 5.2<br>Cb 1<br>1)10'30<br>2)2'29<br>3'01<br>3'36<br>2'04+vr<br>3)4l09<br>4 7'30<br>' 5) 2'32<br>2'21<br>1'57+vr<br>1'TOJ<br>1 | <ul> <li>VIVALDI, Antonio</li> <li>1. Cessate; omai. kantaatti baritonille ja b c:l</li> <li>2. Sonaatti e-moili sellolle ja b c:lie (Largo, A<br/>Allegro) //</li> <li>3.La Senna festiggiante, "pastoraali-serenad<br/>Sinfonia (alkusoitto)</li> <li>4.Piango.gemo, sospiro, kantaatti baritonille</li> <li>5.Sonaatti c-molli viululle, sellolle ja b c:lle (A<br/>Largo, Allegro)</li> <li>Malaguti, Laerte (bar- 1,4) ; R o v e d a, Egio<br/>5);Scrosoppi. Antonio (vl- 5);Sgrizzi, Luciano<br/>(cem - 2,4,5) ; Societa Cameristica di Lugan<br/>L o e h r e r, Edwin (joht- 1,3)</li> </ul> | lie<br>Ilegro, Larqo,<br>ja b c:lle<br>Allegro,<br>dio (vol-2,4,<br>o<br>io'n orkesteri (ork-1,3) | 1)A.P 7.702<br>2)4L PS 6.099 v. i | f<br>/<br>ZBa 2<br>Cd 6<br>Cd 5.2<br>Cb 1<br>1)10'30<br>2)2'29<br>3'01<br>3'36<br>2'04+vr<br>3)4'09<br>4 7' 30<br>' 5) 2'32<br>2'21<br>1'57+vr<br>I ''ra<br>1 | <ul> <li>VIVALDI, Antonio</li> <li>1. Cessate, omai, kantaatti baritonilla</li> <li>2. Sonaatti e-rnolli sellolle ja b c:lie (I<br/>Allegro) //</li> <li>3.La Senna festiggiante, "pastoraali-<br/>Sinfonia (alkusoitto)</li> <li>4.Piango,gemo, sospiro, kantaatti ba</li> <li>5.Sonaatti c-molli viululle, sellolle ja k</li> <li>Largo, Allegro)</li> <li>Malaguti, Laerte (bar- 1,4); R o v e o</li> <li>5); S e r o s o p p i. Antonio (vl- 5); S</li> <li>(cern - 2,4,5); Società Cameristica o</li> <li>L o e h r e r, Edwin (joht- 1,3)</li> </ul> | e ja b c:lie<br>Largo, Allegro, Largo,<br>serenadi'': Il osa :<br>aritonille ja b c:lie<br>b c:lie (Allegro,<br>d a, Egidio (vcl-2,4,<br>grizzi, Luciano<br>di Lugano'n orkesteri (ork-1,3) | 1)+LP 7.702<br>2)+LPS 6.099 v. i |
|---|---|---|-----------------------------------|---|--|---|----------------------------------|
| 3<br>(1) Nonesuch<br>2)Nonesuch H<br>1) kpl 1,2 OK<br>SL/SL 2)kpli;i<br>IJL   | i H 10S8 ; saap, 1966 ; 5 + 5 r ; sel. eng ja tks it,en<br>H 71088takak.<br>5pk,8ek,5SvL-12pun,13val<br>.g <sup>y</sup> -l  | <sup>ng</sup><br>5pk,8ek,5S <sup>L</sup> - 12pun,13va<br>-1                                       | al                                | 3<br>!1) NonesuchH<br>2)NonesuchH7<br>1) kpl 1,2 OK5<br>SL/SL2)kpll'2<br>IJL  | 110S8 ;saap, 1966 ; 5 + 5 r ; sel. eng ja tk<br>71088takak.<br>pk,8ek,5SyL-12pun,13val   | sit,eng<br>5pk,8ek,5S <sup>L</sup> - 12pun,13va<br>-1   | I                                |



## **10. Making the OCR more effective**

- The OCR software (the non-server versions, at least) has plenty of limitations features, e.g.
  - Too many pages (independent of actual size in pixels) cause it to jam (memory extensive application)
  - The software cannot use effectively multiple threads (no multi-CPU support)
  - The software hangs seldomly, but hangs alltogether
  - The software sometimes cannot save its results (OCRred files), causing a hang on the process
  - The software has no shell support for effective scripting (automation)



#### **10. Making the OCR more effective**

- The OCR software manufacturer has multiple versions of its software, including server based applications, but
  - with an additional price per OCRred page)



#### **10. Making the OCR more effective**

- To smooth the OCR process
  - Limit the page count to < 100 (per OCR document)</li>
    - Running typically 9YLE cards = 9\*8 = 72 pages
  - Do nothing else with your computer when the OCR is running
  - Set a task for OCR software with all options & conditions preset
    - Do not allow preprocessing (when doing automated OCRing)



#### **10. Automating the OCR software!**

- To automate the OCR process
  - Create automated process, in which the OCR software always goes through the same folder with the same amount of images and have a master program to call it by window handling, mouse clicks and sort out the file handling
- Show demo

#### **11. Outcome**

- OCR software creates txt files that customer will parse further according to their needs
- For consistency checks, KAR Ltd. also parsed the data into Excel (XLS) spread sheet following the following structure:

| <b>Region information</b> | 1. region            |           |            | 2. region       | 3. region       |
|---------------------------|----------------------|-----------|------------|-----------------|-----------------|
| Region workname           | DISCNRO (~ basename) |           |            | CLASS           | SONGLEN         |
| Description               | stereo/mono          | integer   | side/ring  | mixed codes     | lenght of songs |
| 1. option                 | +LPS                 | 12345     |            | Abc. 123        | 1) XY'Zz        |
| 2. option                 | +LP                  |           | Α          | (several)       | 1. XY'Zz        |
| following options         |                      |           | B1         |                 | XY'Zz           |
|                           |                      |           |            |                 |                 |
| (Data can be missing)     |                      |           | (yes)      | (yes)           | (yes)           |
|                           |                      |           |            |                 |                 |
| 4. region                 | 5. region            | 6. region | 7. region  | 8. region       |                 |
| TITLE                     | SONGNAME             | ARTIST    | PUBLISHER  | ADDINFO         |                 |
| Disk title                | song names           | artist    | publisher  | additional info |                 |
| Disk name                 | song name            | Artist    | Record co. | Writers ID      |                 |
| Composer                  | song name            | composer  | (several)  | Julkaisukielet  |                 |
| (several)                 | (several)            | (several) |            | (several)       |                 |
|                           |                      |           |            |                 |                 |
| (yes)                     | (yes)                | (yes)     | (yes)      | (yes)           |                 |

This table is split after region 3 for layout reasons.

KAR

<u>See results.</u>

In **bold** and *italics* are typical examples of the OCRred text. Region 1 (DISCNRO) is split into 3 columns, others have only 1 column and may be empty.

#### **12.** Conclusions

- Digitizing work is straightforward in the game
  - technical problems can always be solved / made a compromise – practical dilemmas are worse

- OCR is a technical matter
  - one must accept (make compromise) that the quality of the originals sets the baseline;
  - 100 % correctness is nowhere ("should typos be corrected")

#### **12.** Conclusions

 How does one succeed in making successful optical character recognition (OCR) of scanned documents?

- How does one judge success?
  - Error rate to what?
  - At what cost?
- A happy customer is the best measure of all right? ③

### 13. Further work

- The work of KAR Ltd. does not stop here
  - More work has been done already on scanning and OCRing microfilms (fiches) applying the above methods adjusted to the new work / specifications see here

KAR

 KAR Ltd. has just moved to (5 x) bigger location (468 m2) with *more machines and playground* WELCOME TO VISIT US AT ANYTIME! ③ Klaus A J Riederer, Dr. (tech), KAR Ltd, CEO:

You most likely have not learned a thing – but hopefully you have at least thought of something!



Klaus A J Riederer Dr (Tech) image & sound

maker

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KAR Audio KAR Oy Ltd Ab GmbH S.A.R.L.

KAR

WE HAVE JUST MOVED – WE ARE A FACTORY IN: Suurpellontie 1, FI-07700 Koskenkylän saha, Finland www.kar.fi kar@kar.fi KAR Oy Ab Ltd GmbH S.A.R.L

Valokuvavalmistamo KAR, Photography Production KAR, Bildtillverkning KAR, FotografieFertigung KAR, Photographie production KAR Taidevedostamo KAR, Fine Art Printmaking KAR, Konsttryckeri KAR, Kunstdruckwerk KAR, Imprimerie des Beaux-Arts KAR KAR Audio