Generating Time Code Information from Analog Sources

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System for Generating Synchronized Add-On Information for Cinemas

• Making foreign languaged films accessible to local audiences is vital for entertainment, education and cultural exchange
Two approaches: dubbing and subtitling

• Dubbing
  Direct translation replacing the original soundtrack to the audience native tongue.

• Subtitling
  Projecting of text translations to the screen
Dubbing

• Instant and effortless understanding of the dialogs

• Typically done with great care and excellent results by actors, translators and engineers.
Disadvantages

• Any film will suffer artistically. It is not the original voice.

• Films from a different culture played in your own language can be a funny experience

• Professional dubbing is very expensive

• People don‘t get acquainted to foreign languages if they don‘t hear it
Subtitling

- Original soundtrack remains unchanged
- Lower cost for production
- Several countries have a long tradition
Disadvantages

• Interference with screen image

• You have to read it
  – A simple 1:1 translation is mostly impossible even for trained people
  – Some countries developed „summary captioning“
  – People with limited reading capabilities are left behind
• In some parts of the world there are large groups of reading impaired or even illiterate people.

• In Europe it’s more a question of getting acquainted with our different languages, reflecting a variety of cultures.
Third aproach

Imagine going to the cinema and have a pleasant, professional, human voice reading the subtitles —or translating— right into your ear, while you can still enjoy the original soundtrack.
• The Soundtitles system provides assistance for those who need it.

• It doesn‘t replace the soundtrack
• It offers a supplemental source of input

• You get the original sound and the meaning
• With full digital equipped cinemas it would be easy to implement

• But most installations are **analog**.
• Due to the high investment for operators, the path to digital is long.
• The Soundtitles system is a cheap add-on to any existing cinemas

• It basically generates time-code information for playing soundclips or even projecting subtitles itself.
The Soundtitles system contains 3 components

1. SyncTracker: generates timing information
2. ClipPlayer: Plays audio clips
3. SyncPlayer: Projects subtitles or images

• All components are implemented on a standard PC
Key features

1. High flexibility for any projector
2. Easy to use
3. Low cost. No DSP required.
4. Easy to install. Even portable.
5. No special film copy required for subtitles
Core technology

Comparison of two streams via cross-correlation
Similarity metric $s(n)$

\[ s(n) = \sum_{k=1}^{N} x(k) y(k + n) \]
Correlation example
Signal processing

Analyzer PC

Soundcard 48kHz ➔ decimation + bandpass ➔ 8kHz ➔ correlator ➔ sync & tracking

image file ➔ audio player

time code information ➔ subtitle projector

Projector ➔ analog monitor output

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Artefacts from projectors

• Pitch: even low offsets lead to complete out of sync after 2h
  – Pitch estimation and compensation with tracking

• Clicks, crackles, noise: Statistical analysis+consistency check of timing

• „Broken film“: will re-sync automatically but also an emergency manual mode
Image file

• Digital representation of the original soundtrack.

• Compression techniques allow to store several hours on a single CD for easy distribution.
User interface

![User Interface Diagram]

- **Films**: 5th Element, 02:13:23:23
- **Time**: 00:10:12:20
- **Play File 1**: Danish
- **Play File 2**: German
- **Set Time Code**: 00:00:00:00

**Controls**: Manual Set, Analyzer, Sync Player, Sound Set, Load, Auto Play

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Summary

• Dubbing, subtitling
• A third approach->Soundtitles
• Soundtitles system overview
• Implementation
Thank you