

# Compromise

ULTIMEDIA AND ARTIFICIAL INTELLIGENCE

#### Data <u>compr</u>ession paradigm based on <u>omi</u>tting <u>s</u>elf-<u>e</u>vident information

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GeMA

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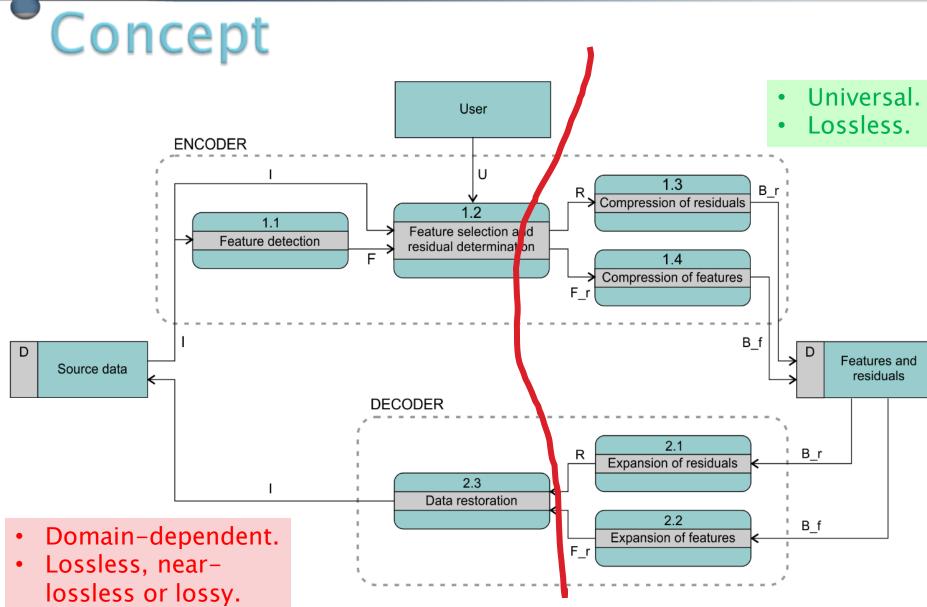
Faculty of Electrical Engineering and Computer Science

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GeMA LABORATORY FOR GEOMETRIC MODELING AND MULTIMEDIA ALGORITHMS







# How to start

#### STEP 1: Choose your data domain.

- 1. Raster images.
- 2. Digital audio.
- 3. Biomedical signals (promissed to be covered by UWB).
- 4. Sparse voxel grids.
- 5. Other ideas also acceptable to prove the concept.
- Within the chosen domain(s), think about reference state-of-theart results (e.g. PNG, JPEG-LS, JP2 for lossless images, FLAC, MPEG-4 ALS for lossless digital audio,...).
- Near lossless extension also needed. Also ability for lossy mode, but we do not compete with lossy methods results!
- Near lossless = lossy with locally controlled errors.



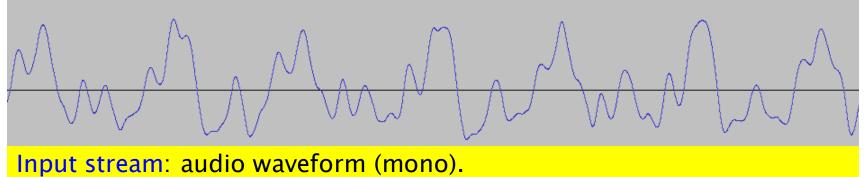
# How to start

- STEP 2: Think about features to be extracted from your input data streams.
  - Domain-dependent feature repertoires till M3.
  - Universal feature taxonomy till M6.
  - Think about universal feature classes while designing domaindependent features already. *Does my domain-dependent feature make sense in some other pilot domain as well*?
  - Examples of features that could possibly be generalized : extreme, sequence, border, pattern, region of interest, rhythm (repetition, trend, ...), symmetry, self-similarity... Use your imagination here!

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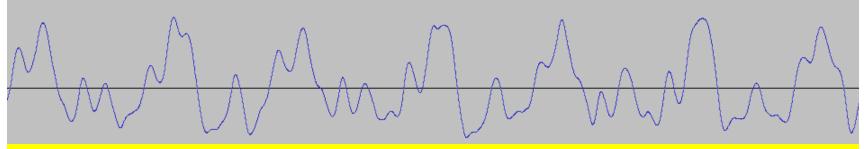
## **STEP 3: feature detection**



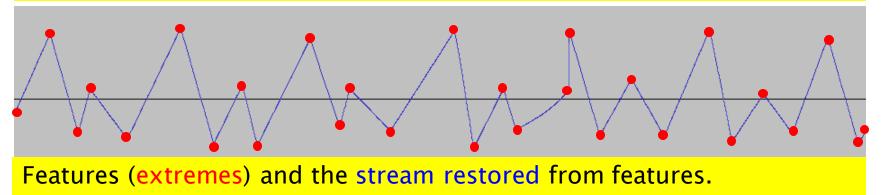
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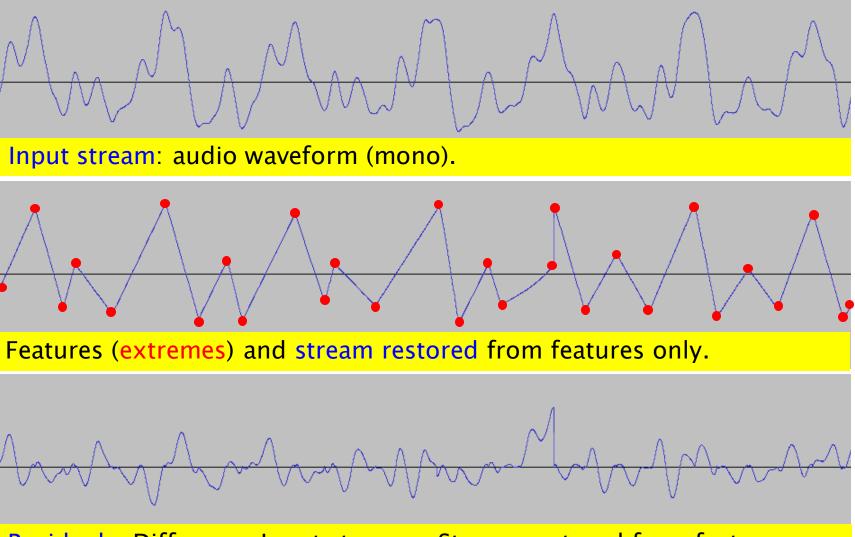
## **STEP 3: feature detection**



#### Input stream: audio waveform (mono)

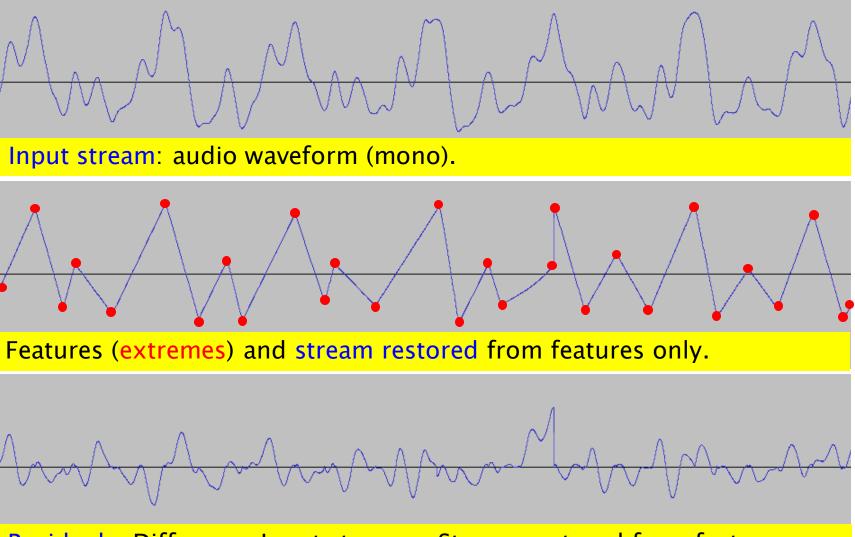






**Residuals**: Difference Input stream – Stream restored from features.



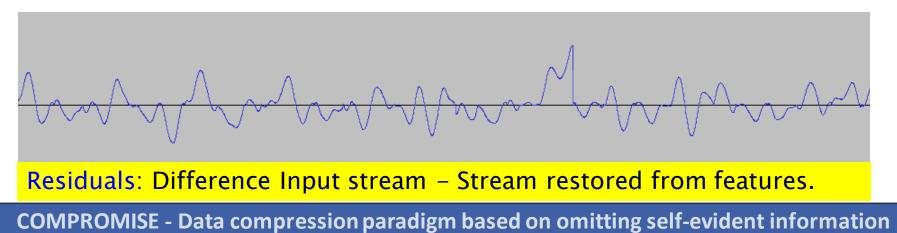


**Residuals**: Difference Input stream – Stream restored from features.

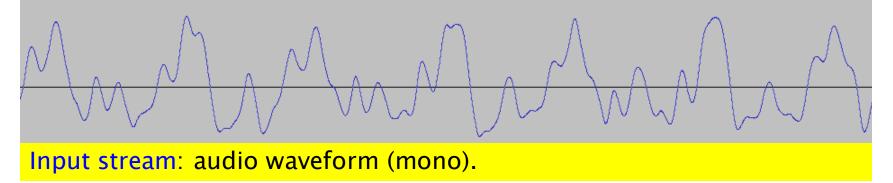




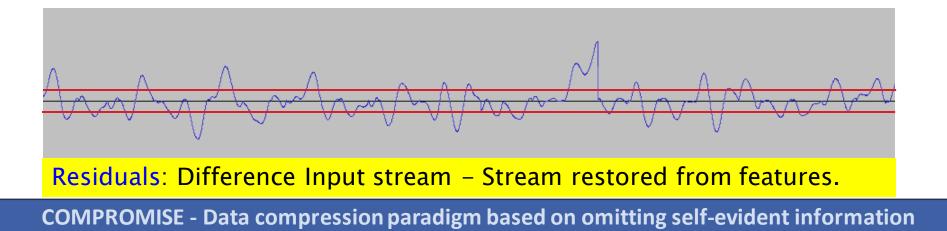
- Features: expectedly below 10% of output data.
- Residuals are more critical.
  - FLAC compresses the input stream a bit more successfully than the residuals. And we still need 10% for features!



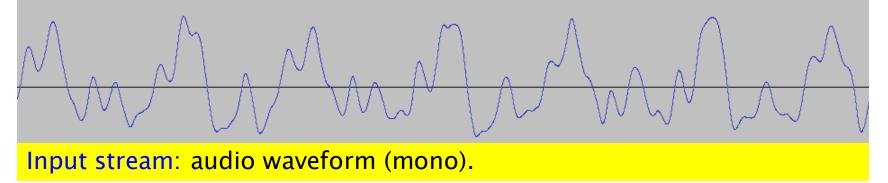




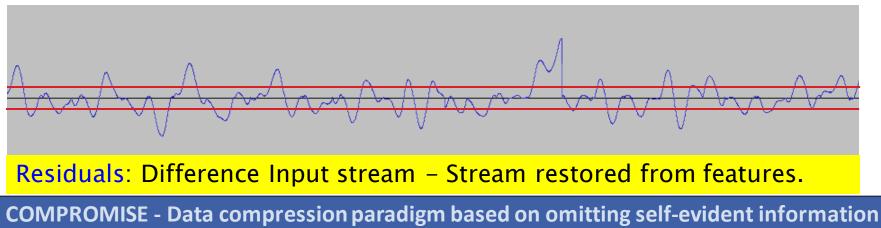
- Iterative optimization process.
- E.g. constrain local errors (amplitudes of residuals), refresh features in critical areas, compute new residuals...



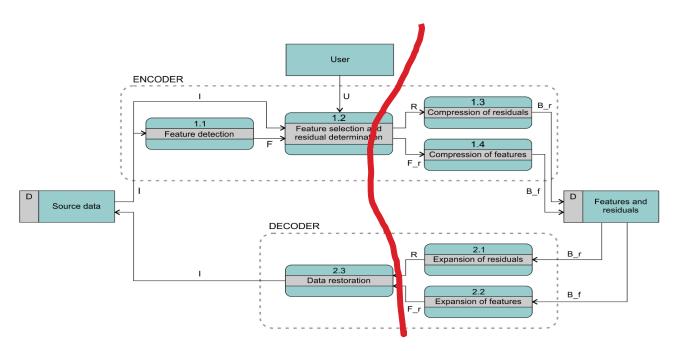




- Perform optimization on the domain-dependent level.
- Lossless, near lossles and lossy separation made here.
- "Translate" features and residuals to the unified level.
- Further optimize at unified level (maybe).



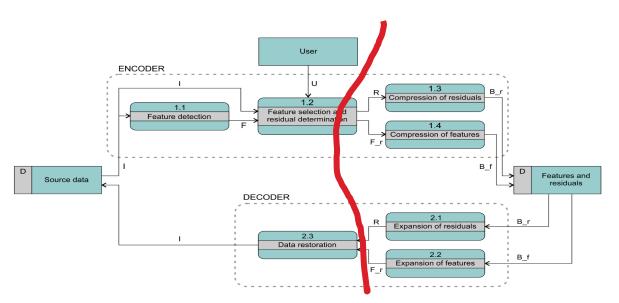




- Red line: feature interpretation.
  - $\rightarrow$  translate domain-dependent features to unified taxonomy.
  - $\rightarrow$  no further changes on residual stream expected.
  - $\leftarrow$  reverse from the above.



# Step 5...: beyond the red line



- Study distributions of residuals and individual unified feature types and choose optimal lossless compression method.
- Ensembles and pipelines of different lossless data transformation and compression methods also acceptable.
- Can be and must be partially done in parallel with 1.1 (and then in parallel with 1.2 and 2.3) – see WP3 and WP4 in workplan.



# Workplan

WP T Work package/task title	Start	End	1	2	3 4	5	6	7	8	9 1	0 11	12	13	14	15 16	17	18	19 2	0 21	22 2	3 24	4 25	26 2	7 28	29	30 31	1 32	33	34 3	5 36
1 Project management	1	36																												
1 Administrative and financial project management	1	36																												
2 Quality assurance and risk mitigation	1	36																												
3 Legal, data and knowledge management	1	36																												
2 Definitions and unified taxonomy of features	1	6																												
1 Generation of domain-dependent feature repertoires	1	3																												
2 Definition of feature descriptions and development of methods for their interpretation	2	6																												
3 Specification of domain-independent feature taxonomy	3	6																												
3 Feature detection, compression, and data restoration	4	21																												
1 Feature detection	4	12																												
2 Data restoration and residual determination	7	20																												
3 Lossless compression of features and residuals	10	21																												
4 Feature selection and optimised residual determination	10	30																												
1 Feature selection	10	27																												
2 Integration of feature selection and residual determination	19	30																												
5 Component integration and hypothesis testing	26	36																												
1 Adaptation of SOTA methods for comparison	26	31																												
2 Component integration	28	32																												
3 Analysis of results, iterative improvements of methodology, and hypothesis testing	30	36																												
6 Dissemination, exploitation, and communication	1	36																												
1 Dissemination, exploitation, and communication strategy	1	36																												
2 Dissemination activities	3	36																												
		MS1													MS2 MS3															
MS1 Proof of concept		MS2 The	e first o	oper	rationa	l prot	otype	base	ed on	redur	ndant	featu	re set	t								MS	3 Optim	ized s	ysten	n based	d on s	select	ed feat	ures



# Deliverables

- > At least 3 papers in international open access journals,
- at least 6 conference papers,
- (above papers not inked to induvidual WPs. Domaindependent results also count.)
- organisation of 2 dedicated presentation events,
- 1 patent application,
- eventual additional requirements from GAČR(?),
- Website and a profile on at least 1 social network (after M6)
  - https://gemma.feri.um.si/projects/slovene-national-research-projects/j2-4458-data-compression-paradigm-based-on-omitting-self-evidentinformation/eng/
- ongoing results at the end of individual WPs (plans, reports, instructions, software, test datasets...).