

pvx Complete HTML Documentation

Total HTML pages included: **23**

Generated by `scripts_generate_docs_pdf.py`.

Contents

1. **01.** ppx HTML Documentation ([index.html](#))
2. **02.** ppx Architecture ([architecture.html](#))
3. **03.** ppx Mathematical Foundations ([math.html](#))
4. **04.** ppx Window Reference ([windows.html](#))
5. **05.** ppx Technical Glossary ([glossary.html](#))
6. **06.** ppx Research Bibliography (Phase Vocoder and Related DSP) ([papers.html](#))
7. **07.** ppx Algorithm Limitations ([limitations.html](#))
8. **08.** ppx Benchmark Report ([benchmarks.html](#))
9. **09.** ppx Pipeline Cookbook ([cookbook.html](#))
10. **10.** ppx CLI Flag Index ([cli_flags.html](#))
11. **11.** ppx Citation Quality ([citations.html](#))
12. **12.** ppx Group: Analysis, QA, and Automation
([groups/analysis_qa_and_automation.html](#))
13. **13.** ppx Group: Creative Spectral Effects
([groups/creative_spectral_effects.html](#))
14. **14.** ppx Group: Denoise and Restoration
([groups/denoise_and_restoration.html](#))
15. **15.** ppx Group: Dereverb and Room Correction
([groups/dereverb_and_room_correction.html](#))
16. **16.** ppx Group: Dynamics and Loudness
([groups/dynamics_and_loudness.html](#))
17. **17.** ppx Group: Granular and Modulation
([groups/granular_and_modulation.html](#))
18. **18.** ppx Group: Pitch Detection and Tracking
([groups/pitch_detection_and_tracking.html](#))
19. **19.** ppx Group: Retune and Intonation
([groups/retune_and_intonation.html](#))
20. **20.** ppx Group: Separation and Decomposition
([groups/separation_and_decomposition.html](#))
21. **21.** ppx Group: Spatial and Multichannel
([groups/spatial_and_multichannel.html](#))
22. **22.** ppx Group: Spectral and Time-Frequency Transforms
([groups/spectral_time_frequency_transforms.html](#))
23. **23.** ppx Group: Time-Scale and Pitch Core
([groups/time_scale_and_pitch_core.html](#))

pvx HTML Documentation

Source: index.html

This HTML documentation is organized by algorithm folder/theme and generated from [src/pvx/algorithms/registry.py](#) and [src/pvx/algorithms/base.py](#) dispatch parameters.

Totals:

- 123 algorithms
- 12 folders/themes
- 100 distinct algorithm parameter keys in dispatch
- 113 linked technical glossary concepts
- 165 bibliography references

Research bibliography (165 references) - foundational and directly related literature for phase vocoder, time-scale/pitch, time-frequency transforms, separation, denoising, dereverberation, spatial audio, and mastering workflows.

Linked technical glossary (113 terms) - quick definitions and external references (Wikipedia, standards pages, docs, and papers).

Mathematical foundations and **window reference (all 50 windows)**.

Architecture diagrams, algorithm limitations, benchmark report, pipeline cookbook, CLI flag index, and **citation quality report**.

GitHub usually shows [.html](#) files as source. For browser-rendered math on GitHub itself, use the Markdown mirrors:

[docs/MATHEMATICAL_FOUNDATIONS.md](#) and [docs/WINDOW_REFERENCE.md](#).

Algorithm Groups

Folder	Theme	Algorithms	Page
time_scale_and_pitch_core	Time-Scale and Pitch Core	7	Open
pitch_detection_and_tracking	Pitch Detection and Tracking	8	Open
retune_and_intonation	Retune and Intonation	8	Open
spectral_time_frequency_transforms	Spectral and Time-Frequency Transforms	8	Open
separation_and_decomposition	Separation and Decomposition	8	Open
denoise_and_restoration	Denoise and Restoration	8	Open
dereverb_and_room_correction	Dereverb and Room Correction	8	Open
dynamics_and_loudness	Dynamics and Loudness	8	Open
creative_spectral_effects	Creative Spectral Effects	8	Open
granular_and_modulation	Granular and Modulation	8	Open
analysis_qa_and_automation	Analysis, QA, and Automation	8	Open
spatial_and_multichannel	Spatial and Multichannel	36	Open

pvx Architecture

Source: architecture.html

Architecture overview for runtime processing, algorithm dispatch, documentation generation, and CI/Pages publication.

Runtime and CLI Flow

Algorithm Registry and Dispatch

```
flowchart TD
    R[src/pvx/algorithms/registry.py] --> B[src/pvx/algorithms/base.py]
    B --> M1[time_scale_and_pitch_core/*]
    B --> M2[retune_and_intonation/*]
    B --> M3[dynamics_and_loudness/*]
    B --> M4[spatial_and_multichannel/*]
```

Documentation Build Graph

```
flowchart LR
    G1[scripts_generate_python_docs.py] --> D[docs/*]
    G2[scripts_generate_theory_docs.py] --> D
    G3[scripts_generate_docs_extras.py] --> D
    G4[scripts_generate_html_docs.py] --> H[docs/html/*]
    D --> H
```

CI and Pages

```
flowchart LR
    PR[Push / PR] --> CI[Doc and test workflow]
    CI --> S[Generation + drift checks]
    S --> T[Unit tests + docs coverage tests]
    T --> P[GitHub Pages deploy workflow]
    P --> SITE[Published docs site]
```

pvx Mathematical Foundations

Source: math.html

Mathematical summary of the core signal-processing model used across pvx. Equations are rendered with MathJax when this page is opened in a normal browser.

GitHub usually displays HTML source text. For GitHub-native math rendering, use [docs/MATHEMATICAL_FOUNDATIONS.md](#).

STFT Analysis and Synthesis

Analysis:

$$X_t[k] = \sum_{n=0}^{N-1} x[n + tH_a]w[n]e^{-j2\pi kn/N}$$

Each frame t is windowed by $w[n]$ and transformed to complex bins k .

Synthesis:

$$\hat{x}[n] = \frac{\sum_t \hat{x}_t[n - tH_s]w[n - tH_s]}{\sum_t w^2[n - tH_s] + \epsilon}$$

Overlap-add with energy normalization preserves level stability.

Transform Backend Selection (`--transform`)

pvx lets you choose the per-frame transform backend used in analysis/resynthesis: `fft`, `dft`, `czt`, `dct`, `dst`, and `hartley`.

Fourier family (`fft`, `dft`):

$$X_t[k] = \sum_{n=0}^{N-1} x_t[n]e^{-j2\pi kn/N}, \quad x_t[n] = \frac{1}{N} \sum_{k=0}^{N-1} X_t[k]e^{j2\pi kn/N}$$

Chirp-Z (`czt`):

$$X_t[k] = \sum_{n=0}^{N-1} x_t[n]A^{-n}W^{nk}$$

With pvx defaults $A = 1$ and $W = e^{-j2\pi/N}$, CZT samples the DFT contour via a different numerical path.

DCT-II (`dct`):

$$C_t[k] = \alpha_k \sum_{n=0}^{N-1} x_t[n] \cos\left(\frac{\pi}{N}(n + \frac{1}{2})k\right)$$

DST-II (`dst`):

$$S_t[k] = \beta_k \sum_{n=0}^{N-1} x_t[n] \sin\left(\frac{\pi}{N}(n + \frac{1}{2})(k + 1)\right)$$

Hartley (`hartley`):

$$H_t[k] = \sum_{n=0}^{N-1} x_t[n] \text{cas}\left(\frac{2\pi kn}{N}\right), \text{cas}(\theta) = \cos \theta + \sin \theta$$

Transform	Why use it	Tradeoffs	Example use case
<code>fft</code>	Fastest and most robust default; best runtime and CUDA support.	Typical STFT leakage/time-resolution tradeoffs still apply.	General production stretch/pitch workflows.
<code>dft</code>	Reference Fourier baseline for transform parity checks.	Usually slower than <code>fft</code> with little audible benefit.	Verification and algorithm A/B testing.
<code>czt</code>	Alternative numerical path for awkward or prime frame sizes.	Requires SciPy; generally slower and CPU-oriented.	Edge-case frame-size validation and diagnostics.
<code>dct</code>	Real-basis energy compaction, useful for envelope-focused shaping.	No explicit complex phase bins; less transparent for strict phase coherence.	Creative timbre shaping and coefficient-domain experiments.
<code>dst</code>	Odd-symmetry real-basis alternative with distinct coloration.	Same phase limitations as DCT; artifacts are content-dependent.	Experimental percussive/spectral texture variants.
<code>hartley</code>	Real transform with Fourier-related basis for exploratory comparisons.	Different bin semantics from complex STFT can change artifact character.	Pedagogical and creative real-domain phase-vocoder tests.

Sample use cases

```
python3 pvvoc.py dialog.wav --transform fft --time-stretch 1.08 --transient-preserve --output-dir out
python3 pvvoc.py tone_sweep.wav --transform dft --time-stretch 1.00 --output-dir out
python3 pvvoc.py archival_take.wav --transform czt --n-fft 1531 --win-length 1531 --hop-size 382 --output-dir out
python3 pvvoc.py strings.wav --transform dct --pitch-shift-cents -17 --output-dir out
python3 pvvoc.py percussion.wav --transform dst --time-stretch 0.92 --phase-locking off --output-dir out
python3 pvvoc.py synth_pad.wav --transform hartley --time-stretch 1.30 --output-dir out
```

Phase-Vocoder Propagation

$$\begin{aligned} \Delta\phi_t[k] &= \text{princarg}\left(\phi_t[k] - \phi_{t-1}[k] - \omega_k H_a\right) \\ \hat{\omega}_t[k] &= \omega_k + \frac{\Delta\phi_t[k]}{H_a} \\ \hat{\phi}_t[k] &= \hat{\phi}_{t-1}[k] + \hat{\omega}_t[k] H_s \end{aligned}$$

pvx uses these relationships to estimate true instantaneous frequency and re-accumulate phase under a new synthesis hop.

Pitch and Microtonal Mapping

$$r_{\text{pitch}} = 2^{\Delta s / 12} = 2^{\Delta c / 1200}$$

Semitone shift Δs and cents shift Δc are equivalent ratio controls. Scale-constrained retuning maps detected F0 to the nearest permitted scale target.

Dynamics and Loudness

$$g_{\text{LUFs}} = 10^{(L_{\text{target}} - L_{\text{in}})/20}$$

$$y[n] = x[n] \cdot g_{\text{LUFS}}$$

Target-loudness gain is applied in linear amplitude domain after dynamics stages, before limiting/clipping safety stages.

Spatial and Multichannel Highlights

Delay-and-sum beamforming:

$$y[n] = \frac{1}{M} \sum_{m=1}^M x_m[n - \tau_m]$$

MVDR weights:

$$\mathbf{w} = \frac{\mathbf{R}^{-1}\mathbf{d}}{\mathbf{d}^H \mathbf{R}^{-1}\mathbf{d}}$$

FOA encode (WXYZ):

$$W = \frac{s}{\sqrt{2}}, \quad X = s \cos \theta \cos \varphi, \quad Y = s \sin \theta \cos \varphi, \quad Z = s \sin \varphi$$

pvx spatial modules combine beamforming, ambisonic transformations, and phase-vocoder-consistent multichannel processing for robust chain composition.

pvx Window Reference

Source: windows.html

Complete pvx analysis-window reference. This page covers all **50** supported windows from `pvx.core.voc.WINDOW_CHOICES`, with formula-family mapping and practical interpretation.

For GitHub-native equation rendering, use [docs/WINDOW_REFERENCE.md](#).

Quantitative metrics and per-window SVG plots are generated from `docs/window_metrics.json` and `docs/assets/windows/*`.

Window Formula Key

Let $n = 0, \dots, N - 1$, center index $m = (N - 1)/2$, and normalized coordinate $x_n = (n - m)/m$.

(W0) Rectangular:

$$w[n] = 1$$

(W1) Cosine series:

$$w[n] = \sum_{k=0}^K a_k \cos\left(\frac{2\pi kn}{N-1}\right)$$

(W2) Sine/Cosine:

$$w[n] = \sin\left(\frac{\pi n}{N-1}\right)$$

(W3) Bartlett:

$$w[n] = 1 - \left| \frac{n-m}{m} \right|$$

(W4) Triangular:

$$w[n] = \max\left(1 - \left| \frac{n-m}{(N+1)/2} \right|, 0\right)$$

(W5) Bartlett-Hann:

$$x = \frac{n}{N-1} - \frac{1}{2}, \quad w[n] = 0.62 - 0.48|x| + 0.38 \cos(2\pi x)$$

(W6) Tukey:

$$x = \frac{n}{N-1}, \quad w[n] = \begin{cases} \frac{1}{2}(1 + \cos(\pi(\frac{2x}{\alpha} - 1))), & 0 \leq x < \frac{\alpha}{2} \\ 1, & \frac{\alpha}{2} \leq x < 1 - \frac{\alpha}{2} \\ \frac{1}{2}(1 + \cos(\pi(\frac{2x}{\alpha} - \frac{2}{\alpha} + 1))), & 1 - \frac{\alpha}{2} \leq x \leq 1 \end{cases}$$

pvx special cases: $\alpha \leq 0$ is rectangular and $\alpha \geq 1$ becomes Hann.

(W7) Parzen:

$$\$u=\left|\frac{2n}{N-1}-1\right|, \quad w[n]=\begin{cases} 1-6u^2+6u^3, & 0 \leq u \leq \frac{1}{2} \\ \frac{1}{2}(1+\cos(\pi(\frac{2u}{\alpha}-\frac{2}{\alpha}+1))), & 1-\frac{\alpha}{2} \leq u \leq 1 \end{cases}$$

(W8) Lanczos:

$$w[n] = \text{sinc}\left(\frac{2n}{N-1} - 1\right)$$

(W9) Welch:

$$w[n] = \max(1 - x_n^2, 0)$$

(W10) Gaussian:

$$w[n] = \exp\left(-\frac{1}{2}\left(\frac{n-m}{\sigma}\right)^2\right), \sigma = r_\sigma m$$

(W11) General Gaussian:

$$w[n] = \exp\left(-\frac{1}{2}\left|\frac{n-m}{\sigma}\right|^{2p}\right)$$

(W12) Exponential:

$$w[n] = \exp\left(-\frac{|n-m|}{\tau}\right), \tau = r_\tau m$$

(W13) Cauchy:

$$w[n] = \frac{1}{1 + \left(\frac{n-m}{\gamma}\right)^2}, \gamma = r_\gamma m$$

(W14) Cosine power:

$$w[n] = \sin\left(\frac{\pi n}{N-1}\right)^p$$

(W15) Hann-Poisson:

$$w[n] = w_{\text{Hann}}[n] \exp\left(-\alpha \frac{|n-m|}{m}\right)$$

(W16) General Hamming:

$$w[n] = \alpha - (1-\alpha) \cos\left(\frac{2\pi n}{N-1}\right)$$

(W17) Bohman:

$$x = \left| \frac{2n}{N-1} - 1 \right|, \quad w[n] = (1-x) \cos(\pi x) + \frac{\sin(\pi x)}{\pi}$$

(W18) Kaiser:

$$w[n] = \frac{I_0\left(\beta\sqrt{1-r_n^2}\right)}{I_0(\beta)}, \quad r_n = \frac{n-m}{m}$$

Each window name in the table maps to one formula family above plus fixed constants/shape parameters.

Window	Family	Parameters	Formula key	Coherent gain	ENBW (bins)	Scalloping loss (dB)	Main-lobe width (bins)	Peak sidelobe (dB)	Plots	Plain-Eng behavior
hann	Cosine series	coeffs= (0.5, -0.5)	W1	0.499756	1.500733	-1.422	4.000	-31.468	time / freq	Cosine-staper balancing leakage a resolution

Window	Family	Parameters	Formula key	Coherent gain	ENBW (bins)	Scalloping loss (dB)	Main-lobe width (bins)	Peak sidelobe (dB)	Plots	Plain-Eng behavior
hamming	Cosine series	<code>coeffs=(0.54, -0.46)</code>	W1	0.539775	1.363305	-1.750	4.000	-42.675	time / freq	Cosine-si taper balancing leakage a resolution
blackman	Cosine series	<code>coeffs=(0.42, -0.5, 0.08)</code>	W1	0.419795	1.727601	-1.098	6.000	-58.109	time / freq	Cosine-si taper balancing leakage a resolution
blackmanharris	Cosine series	<code>coeffs=(0.35875, -0.48829, 0.14128, -0.01168)</code>	W1	0.358575	2.005332	-0.825	8.000	-92.011	time / freq	Cosine-si taper balancing leakage a resolution
nuttal	Cosine series	<code>coeffs=(0.355768, -0.487396, 0.144232, -0.012604)</code>	W1	0.355594	2.022220	-0.811	8.000	-93.325	time / freq	Cosine-si taper balancing leakage a resolution
flattop	Cosine series	<code>coeffs=(1, -1.93, 1.29, -0.388, 0.0322)</code>	W1	0.999514	3.772117	-0.016	10.000	-68.311	time / freq	Cosine-si taper balancing leakage a resolution
blackman_nuttall	Cosine series	<code>coeffs=(0.363582, -0.489177, 0.1366, -0.010641)</code>	W1	0.363405	1.977073	-0.850	8.000	-98.174	time / freq	Cosine-si taper balancing leakage a resolution
exact_blackman	Cosine series	<code>coeffs=(0.426591, -0.496561, 0.0768487)</code>	W1	0.426386	1.694500	-1.149	6.000	-68.236	time / freq	Cosine-si taper balancing leakage a resolution
sine	Sinusoidal	<code>none</code>	W2	0.636309	1.234304	-2.096	3.000	-22.999	time / freq	Raised-si taper; sm edges with moderate main-lobe width.

Window	Family	Parameters	Formula key	Coherent gain	ENBW (bins)	Scalloping loss (dB)	Main-lobe width (bins)	Peak sidelobe (dB)	Plots	Plain-Eng behavior
bartlett	Triangular	none	W3	0.499756	1.333985	-1.822	4.000	-26.523	time / freq	Linear triangular taper; sim and fast.
boxcar	Rectangular	none	W0	1.000000	1.000000	-3.922	2.000	-13.264	time / freq	No taper; best freq resolution strongest leakage.
triangular	Triangular	none	W4	0.500244	1.332683	-1.826	4.000	-26.523	time / freq	Triangular taper varies with denominator ($N + 1$),
bartlett_hann	Hybrid taper	fixed coefficients	W5	0.499756	1.456559	-1.517	4.000	-35.874	time / freq	Blend of Bartlett-like slope and cosine curvature
tukey	Tukey	alpha=0.5	W6	0.749634	1.222819	-2.236	2.656	-15.123	time / freq	Cosine tapers at edges, flat center region.
tukey_0p1	Tukey	alpha=0.1	W6	0.949536	1.039289	-3.505	2.094	-13.309	time / freq	Cosine tapers at edges, flat center region.
tukey_0p25	Tukey	alpha=0.25	W6	0.874573	1.102579	-2.960	2.281	-13.601	time / freq	Cosine tapers at edges, flat center region.
tukey_0p75	Tukey	alpha=0.75	W6	0.624695	1.360664	-1.728	3.188	-19.395	time / freq	Cosine tapers at edges, flat center region.
tukey_0p9	Tukey	alpha=0.9	W6	0.549731	1.446988	-1.521	3.625	-24.972	time / freq	Cosine tapers at edges, flat center region.
parzen	Polynomial	piecewise cubic	W7	0.374817	1.918397	-0.897	8.000	-53.046	time / freq	Smooth piecewise cubic window with strong sidelobe suppression

Window	Family	Parameters	Formula key	Coherent gain	ENBW (bins)	Scalloping loss (dB)	Main-lobe width (bins)	Peak sidelobe (dB)	Plots	Plain-Eng behavior
lanczos	Sinc	none	W8	0.589202	1.299668	-1.889	3.281	-26.405	time / freq	Sinc-based taper with useful compromise for spectral analysis.
welch	Quadratic	none	W9	0.666341	1.200587	-2.223	2.875	-21.295	time / freq	Parabolic emphasizes center samples.
gaussian_0p25	Gaussian	sigma_ratio=0.25	W10	0.313156	2.258144	-0.668	11.406	-87.677	time / freq	Bell-shaped taper; small sigma gives stronger & attenuating
gaussian_0p35	Gaussian	sigma_ratio=0.35	W10	0.436580	1.626488	-1.268	6.719	-52.077	time / freq	Bell-shaped taper; small sigma gives stronger & attenuating
gaussian_0p45	Gaussian	sigma_ratio=0.45	W10	0.548949	1.320556	-1.869	4.125	-35.366	time / freq	Bell-shaped taper; small sigma gives stronger & attenuating
gaussian_0p55	Gaussian	sigma_ratio=0.55	W10	0.641515	1.171861	-2.350	3.000	-28.906	time / freq	Bell-shaped taper; small sigma gives stronger & attenuating
gaussian_0p65	Gaussian	sigma_ratio=0.65	W10	0.713490	1.097657	-2.705	2.625	-22.575	time / freq	Bell-shaped taper; small sigma gives stronger & attenuating
general_gaussian_1p5_0p35	Generalized Gaussian	power=1.5, sigma_ratio=0.35	W11	0.393587	2.016584	-0.784	5.156	-24.895	time / freq	Adjustable shape exponent controls shoulder steepness
general_gaussian_2p0_0p35	Generalized Gaussian	power=2, sigma_ratio=0.35	W11	0.377081	2.230016	-0.633	5.281	-19.717	time / freq	Adjustable shape exponent controls shoulder steepness

Window	Family	Parameters	Formula key	Coherent gain	ENBW (bins)	Scalloping loss (dB)	Main-lobe width (bins)	Peak sidelobe (dB)	Plots	Plain-Eng behavior
general_gaussian_3p0_0p35	Generalized Gaussian	power=3, sigma_ratio=0.35	W11	0.364287	2.445593	-0.532	5.469	-16.299	time / freq	Adjustable shape exponent controls shoulder steepness
general_gaussian_4p0_0p35	Generalized Gaussian	power=4, sigma_ratio=0.35	W11	0.359267	2.552433	-0.496	5.562	-15.060	time / freq	Adjustable shape exponent controls shoulder steepness
exponential_0p25	Exponential	tau_ratio=0.25	W12	0.245310	2.075492	-1.022	15.562	-31.885	time / freq	Symmetric exponent decay away from cent
exponential_0p5	Exponential	tau_ratio=0.5	W12	0.432187	1.313323	-2.032	3.625	-19.190	time / freq	Symmetric exponent decay away from cent
exponential_1p0	Exponential	tau_ratio=1	W12	0.631991	1.082055	-2.854	2.594	-20.141	time / freq	Symmetric exponent decay away from cent
cauchy_0p5	Cauchy / Lorentzian	gamma_ratio=0.5	W13	0.553402	1.229775	-2.209	3.562	-22.733	time / freq	Heavy-tail taper with slower side decay than Gaussian
cauchy_1p0	Cauchy / Lorentzian	gamma_ratio=1	W13	0.785259	1.041963	-3.108	2.375	-19.034	time / freq	Heavy-tail taper with slower side decay than Gaussian
cauchy_2p0	Cauchy / Lorentzian	gamma_ratio=2	W13	0.927233	1.004393	-3.648	2.094	-14.689	time / freq	Heavy-tail taper with slower side decay than Gaussian
cosine_power_2	Cosine power	power=2	W14	0.499756	1.500733	-1.422	4.000	-31.468	time / freq	Raises side taper to p; higher narrows effective support.

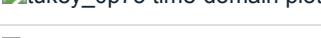
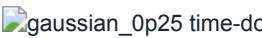
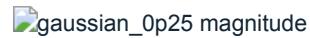
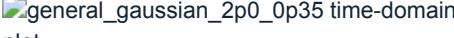
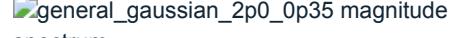
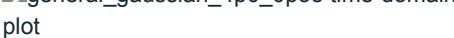
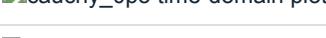
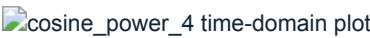
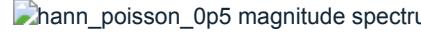
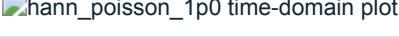
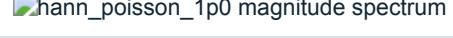
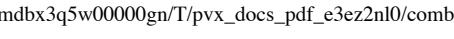
Window	Family	Parameters	Formula key	Coherent gain	ENBW (bins)	Scalloping loss (dB)	Main-lobe width (bins)	Peak sidelobe (dB)	Plots	Plain-Eng behavior
<code>cosine_power_3</code>	Cosine power	<code>power=3</code>	W14	0.424206	1.735739	-1.074	5.000	-39.295	<code>time / freq</code>	Raises side-taper to power p ; higher p narrows effective support.
<code>cosine_power_4</code>	Cosine power	<code>power=4</code>	W14	0.374817	1.945394	-0.862	6.000	-46.741	<code>time / freq</code>	Raises side-taper to power p ; higher p narrows effective support.
<code>hann_poisson_0p5</code>	Hann-Poisson	<code>alpha=0.5</code>	W15	0.432946	1.609944	-1.258	5.188	-35.245	<code>time / freq</code>	Hann multiplied exponent envelope stronger ϵ decay.
<code>hann_poisson_1p0</code>	Hann-Poisson	<code>alpha=1</code>	W15	0.378797	1.734176	-1.112	103.750	-80.017	<code>time / freq</code>	Hann multiplied exponent envelope stronger ϵ decay.
<code>hann_poisson_2p0</code>	Hann-Poisson	<code>alpha=2</code>	W15	0.297878	2.023174	-0.870	164.719	-80.005	<code>time / freq</code>	Hann multiplied exponent envelope stronger ϵ decay.
<code>general_hamming_0p50</code>	General Hamming	<code>alpha=0.50</code>	W16	0.499756	1.500733	-1.422	4.000	-31.468	<code>time / freq</code>	Hamming family with tunable α weight.
<code>general_hamming_0p60</code>	General Hamming	<code>alpha=0.60</code>	W16	0.599805	1.222475	-2.179	3.469	-31.600	<code>time / freq</code>	Hamming family with tunable α weight.
<code>general_hamming_0p70</code>	General Hamming	<code>alpha=0.70</code>	W16	0.699854	1.091920	-2.762	2.656	-24.078	<code>time / freq</code>	Hamming family with tunable α weight.
<code>general_hamming_0p80</code>	General Hamming	<code>alpha=0.80</code>	W16	0.799902	1.031273	-3.227	2.312	-18.649	<code>time / freq</code>	Hamming family with tunable α weight.

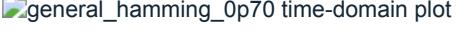
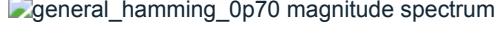
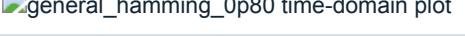
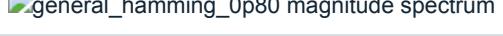
Window	Family	Parameters	Formula key	Coherent gain	ENBW (bins)	Scalloping loss (dB)	Main-lobe width (bins)	Peak sidelobe (dB)	Plots	Plain-Eng behavior
bohman	Bohman	none	W17	0.405087	1.786613	-1.022	6.000	-45.997	time / freq	Continuous slope window with cosine plus sine corrector
cosine	Sinusoidal	none	W2	0.636309	1.234304	-2.096	3.000	-22.999	time / freq	Same implementation as sine window in ppx.
kaiser	Kaiser-Bessel	beta from --kaiser-beta	W18	0.331708	2.162181	-0.712	9.125	-105.921	time / freq	Adjustable trade-off window using modified Bessel function.
rect	Rectangular	none	W0	1.000000	1.000000	-3.922	2.000	-13.264	time / freq	Alias of boxcar in ppx.

Complete Plot Gallery (All Windows)

Time-domain and frequency-magnitude plots for every supported window.

Window	Time-domain shape	Magnitude spectrum
hann		
hamming		
blackman		
blackmanharris		
nuttall		
flattop		
blackman_nuttall		
exact_blackman		
sine		
bartlett		
boxcar		
triangular		
bartlett_hann		

Window	Time-domain shape	Magnitude spectrum
tukey		
tukey_0p1		
tukey_0p25		
tukey_0p75		
tukey_0p9		
parzen		
lanczos		
welch		
gaussian_0p25		
gaussian_0p35		
gaussian_0p45		
gaussian_0p55		
gaussian_0p65		
general_gaussian_1p5_0p35		
general_gaussian_2p0_0p35		
general_gaussian_3p0_0p35		
general_gaussian_4p0_0p35		
exponential_0p25		
exponential_0p5		
exponential_1p0		
cauchy_0p5		
cauchy_1p0		
cauchy_2p0		
cosine_power_2		
cosine_power_3		
cosine_power_4		
hann_poisson_0p5		
hann_poisson_1p0		
hann_poisson_2p0		
general_hamming_0p50		
general_hamming_0p60		

Window	Time-domain shape	Magnitude spectrum
general_hamming_0p70		
general_hamming_0p80		
bohman		
cosine		
kaiser		
rect		

pvx Technical Glossary

Source: glossary.html

Linked glossary for core concepts used throughout ppx algorithms, CLIs, and research docs. Entries include concise definitions plus external references (Wikipedia, standards pages, project docs, and canonical papers).

Total terms: **113** across **10** categories.

Categories

- Core DSP Math (15)
- Phase and Time-Scale DSP (11)
- Pitch and Intonation (12)
- Time-Frequency Transforms (8)
- Separation and Decomposition (8)
- Denoising and Restoration (13)
- Dynamics and Mastering (10)
- Creative Spectral Effects (8)
- Spatial Audio and Multichannel (20)
- Analysis and QA (8)

Core DSP Math

Term	Description	External link
Aliasing	Frequency-domain folding caused by undersampling. Unchecked aliasing folds out-of-band content back into the audible band, often creating false partials or metallic artifacts.	Reference
Blackman window	Cosine-sum window with stronger sidelobe suppression. In ppx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Convolution	Linear filtering operation in time domain equivalent to multiplication in frequency domain. In ppx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Fast Fourier transform (FFT)	Efficient algorithm for computing the discrete Fourier transform. Its computational efficiency is critical because ppx repeatedly computes FFTs frame-by-frame across channels and files.	Reference
Fourier transform	Transforms a signal from time domain to frequency domain. In ppx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Hamming window	Cosine-sum window with reduced nearest sidelobe amplitude. Compared with Hann it slightly reduces nearest sidelobes, often at the cost of different amplitude bias characteristics.	Reference
Hann window	Raised cosine window commonly used in STFT analysis. It is a common default because it offers a strong practical balance between leakage control and frequency resolution.	Reference
Inverse FFT (IFFT)	Inverse operation that reconstructs time-domain samples from spectral bins. Accurate inverse transforms are required to reconstruct low-artifact audio after spectral-domain edits.	Reference
Kaiser window	Parametric window controlled by beta parameter. The beta parameter gives explicit control over the width-versus-sidelobe tradeoff, which is useful for task-specific tuning.	Reference

Term	Description	External link
Linear phase	Filter phase response that preserves waveform shape of band-limited signals. In pvx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Minimum phase	System with minimum group delay for a given magnitude response. In pvx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Nyquist frequency	Half the sample rate; highest representable frequency in sampled audio. In pvx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Overlap-add (OLA)	Frame-based reconstruction by summing overlapped windowed segments. In pvx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Spectral leakage	Energy spread across bins due to finite-duration analysis windows. In pvx workflows this directly affects spectral resolution, leakage behavior, and overlap-add reconstruction accuracy in STFT-based processing.	Reference
Window function	Tapering function applied before spectral analysis to control leakage. Window shape selection is one of the strongest controls on sidelobe suppression versus main-lobe width.	Reference

Phase and Time-Scale DSP

Term	Description	External link
Formant preservation	Preservation of spectral envelope while pitch is changed. This helps avoid chipmunk/monster timbre artifacts when pitch is shifted significantly.	Reference
Granular synthesis	Sound synthesis/modification using short grains. In pvx this concept determines how frames are aligned, phases are propagated, and transients are preserved during time-stretch and pitch operations.	Reference
HPSS	Harmonic-percussive source separation in TF domain. Harmonic and percussive components can then be processed with different settings to preserve punch while shaping sustain.	Reference
Identity phase locking	Phase-locking variant that follows dominant peaks. In pvx this concept determines how frames are aligned, phases are propagated, and transients are preserved during time-stretch and pitch operations.	Reference
LP-PSOLA	Linear-prediction-assisted PSOLA variant. Linear-prediction support can improve source/filter control and reduce timbral drift in speech-like material.	Reference
Phase locking	Locking neighboring bin phases to preserve local waveform structure. Locking strategies reduce local phase incoherence, improving clarity and reducing chorus-like blur in stretched material.	Reference
Phase vocoder	STFT-based time-scale/pitch framework using phase propagation. It underpins most pvx core transforms by decoupling time-scale and pitch behavior through phase-consistent spectral resynthesis.	Reference
TD-PSOLA	Time-domain pitch-synchronous overlap-add technique. It is effective for voiced monophonic content where pitch periods are trackable and edits should remain time-domain natural.	Reference
Time warp map	Piecewise mapping from output time to input time. In pvx this concept determines how frames are aligned, phases are propagated, and transients are preserved during time-stretch and pitch operations.	Reference
Transient preservation	Strategies that protect attacks during spectral time modification. Without transient-aware handling, attacks can smear, so this is central for drums and articulation-critical material.	Reference

Term	Description	External link
WSOLA	Waveform-similarity overlap-add time-scale modification. It is often preferred for moderate speech/music time changes when waveform continuity is more important than heavy spectral editing.	Reference

Pitch and Intonation

Term	Description	External link
Cents	Logarithmic pitch interval unit (1200 cents per octave). Because cents are logarithmic, fixed cent offsets represent musically consistent relative pitch intervals anywhere in the register.	Reference
Equal temperament	Tuning system dividing octave into equal semitone ratios. It is the default modern tuning grid but may be intentionally replaced for historical or microtonal work.	Reference
Harmonic product spectrum	Downsample-and-multiply spectrum for F0 evidence. In pvx retune pipelines this governs pitch-target decisions, microtonal mapping behavior, and the stability of note-to-note correction.	Reference
Just intonation	Tuning based on low-integer frequency ratios. Its pure-ratio intervals can sound more consonant in context but depend strongly on key and harmonic function.	Reference
MIDI Tuning Standard	Specification for non-12TET tuning in MIDI systems. This enables compatible systems to exchange alternate tunings without redefining note identities.	Reference
Portamento	Continuous slide between notes. Retune systems often need slide-aware logic so expressive glides are not flattened into abrupt quantized jumps.	Reference
pYIN	Probabilistic extension of YIN with voicing model. Its probabilistic voicing model can improve contour stability relative to raw framewise estimates.	Reference
RAPT	Robust algorithm for pitch tracking. In pvx retune pipelines this governs pitch-target decisions, microtonal mapping behavior, and the stability of note-to-note correction.	Reference
Scala scale format	Text format for microtonal scales. Using Scala files allows precise import of non-12TET interval maps into repeatable production workflows.	Reference
Subharmonic summation	Weighted subharmonic summation for F0 estimation. In pvx retune pipelines this governs pitch-target decisions, microtonal mapping behavior, and the stability of note-to-note correction.	Reference
SWIPE	Sawtooth-waveform inspired pitch estimator. It emphasizes sawtooth-like harmonic structure, which can improve robustness on certain voiced spectra.	Reference
YIN	Fundamental-frequency estimator using difference-function minima. It is commonly used as a robust baseline detector for monophonic F0 tracks.	Reference

Time-Frequency Transforms

Term	Description	External link
Chirplet transform	Transform using chirped atoms. In pvx transform modules this shapes the tradeoff between time localization, frequency precision, and invertibility of analysis/resynthesis steps.	Reference
Constant-Q transform (CQT)	Transform with logarithmic center frequencies and constant Q. Its logarithmic spacing is especially useful for music analysis where pitch perception is logarithmic.	Reference
Multiresolution analysis	Nested subspace structure for multi-scale representations. In pvx transform modules this shapes the tradeoff between time localization, frequency precision, and invertibility of analysis/resynthesis steps.	Reference

Term	Description	External link
NSGT	Nonstationary Gabor transform with invertible adaptive filter banks. NSGT offers adaptive, invertible filter-bank behavior beyond fixed-resolution STFT framing.	Reference
Reassigned spectrogram	Sharper TF representation by moving energy to local centroids. Reassignment can sharpen time-frequency energy localization for clearer ridge and onset interpretation.	Reference
Synchrosqueezing	Post-processing that concentrates TF energy along ridges. It can concentrate ridge energy for improved instantaneous-frequency interpretation.	Reference
Variable-Q transform (VQT)	Generalized CQT with variable Q and bandwidth behavior. Compared to CQT, VQT broadens control over Q and bandwidth behavior across frequency ranges.	Reference
Wavelet packet	Hierarchical wavelet decomposition of both low/high branches. It supports multi-band decomposition where both approximation and detail branches are recursively analyzed.	Reference

Separation and Decomposition

Term	Description	External link
CP decomposition	Canonical polyadic tensor decomposition. In ppx decomposition workflows this assumption controls source isolation quality, bleed rejection, and the interpretability of separated components.	Reference
Demucs	Deep waveform-domain music source separation architecture. Neural stem separation quality can be high, but behavior depends heavily on training-domain match.	Reference
ICA	Blind source separation based on statistical independence. In ppx decomposition workflows this assumption controls source isolation quality, bleed rejection, and the interpretability of separated components.	Reference
NMF	Nonnegative factorization of matrices into parts-based components. Factor count and constraints strongly influence whether components are musically meaningful or overly fragmented.	Reference
RPCA	Low-rank + sparse decomposition robust to outliers. It is frequently used to separate stable backgrounds from sparse foreground events.	Reference
Tensor decomposition	Higher-order extension of matrix factorization. In ppx decomposition workflows this assumption controls source isolation quality, bleed rejection, and the interpretability of separated components.	Reference
Tucker decomposition	Core tensor with mode matrices factorization. In ppx decomposition workflows this assumption controls source isolation quality, bleed rejection, and the interpretability of separated components.	Reference
U-Net	Encoder-decoder CNN with skip connections. In ppx decomposition workflows this assumption controls source isolation quality, bleed rejection, and the interpretability of separated components.	Reference

Denoising and Restoration

Term	Description	External link
Blind deconvolution	Joint estimation of source and room/filter response. In ppx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
Declick	Removal of impulsive click artifacts. In ppx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
Declip	Reconstruction of clipped waveform segments. In ppx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference

Term	Description	External link
Dereverberation	Suppression of late reverberation components. In pvx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
Diffusion model	Generative model based on iterative denoising processes. In pvx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
Direct-to-reverberant ratio (DRR)	Ratio of direct sound energy to reverberant energy. In pvx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
Log-MMSE	Log-spectral MMSE enhancement estimator. Its log-domain objective often better tracks perceptual sensitivity than raw-amplitude objectives.	Reference
Minimum statistics	Noise tracking from low percentile/minimum spectral statistics. In pvx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
MMSE-STSA	MMSE short-time spectral amplitude estimator. It estimates clean spectral amplitudes from noisy observations while minimizing expected short-time error.	Reference
RNNnoise	Hybrid recurrent neural + DSP speech denoiser. In pvx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
Spectral subtraction	Subtracts estimated noise spectrum from noisy signal. In pvx restoration chains this controls denoise or dereverb strength versus artifact risk, helping balance intelligibility and texture retention.	Reference
Weighted prediction error (WPE)	Multi-channel dereverb by delayed linear prediction. WPE is a standard dereverberation baseline for suppressing late reverberant tails in multichannel settings.	Reference
Wiener filter	MMSE linear estimator for noisy observations. It is a classic linear MMSE approach and still valuable as a reliable baseline enhancer.	Reference

Dynamics and Mastering

Term	Description	External link
Compander	Combined compressor and expander behavior. In pvx mastering stages this affects loudness compliance, peak containment, and perceived punch versus transparency across final renders.	Reference
Compressor	Dynamic range processor that reduces gain above threshold. Threshold, ratio, attack, and release jointly define how quickly and how strongly level is controlled.	Reference
EBU R128	European loudness standard for production and broadcast. R128 operationalizes BS.1770 loudness measurement into practical broadcast and production targets.	Reference
Expander	Dynamic processor that reduces gain below threshold. It can reduce low-level noise floors and room tail audibility by attenuating content below threshold.	Reference
Hard clipping	Abrupt saturation by truncating waveform beyond threshold. In pvx mastering stages this affects loudness compliance, peak containment, and perceived punch versus transparency across final renders.	Reference
ITU-R BS.1770	International loudness measurement recommendation. Its weighting and gating model is the industry baseline for objective integrated loudness measurement.	Reference
Limiter	High-ratio compressor preventing peaks from exceeding threshold. In mastering chains it is commonly the final safety stage to prevent over-level peaks.	Reference

Term	Description	External link
LUFS	Loudness unit relative to full scale. Targeting LUFS helps keep perceived program loudness consistent across tracks and delivery contexts.	Reference
Soft clipping	Smooth saturation curve reducing harsh distortion. In pvx mastering stages this affects loudness compliance, peak containment, and perceived punch versus transparency across final renders.	Reference
True peak	Peak estimate including inter-sample overs. True-peak metering estimates inter-sample peaks that sample-peak meters can miss.	Reference

Creative Spectral Effects

Term	Description	External link
Amplitude modulation (AM)	Modulating signal amplitude by a control waveform. In pvx creative processing this primarily controls intentional timbral coloration and motion, not transparent corrective behavior.	Reference
Cross synthesis	Combining spectral magnitude and phase or envelopes across signals. Different choices of magnitude/phase or envelope transfer produce very different timbral identities.	Reference
Formant	Resonance region of spectral envelope. In pvx creative processing this primarily controls intentional timbral coloration and motion, not transparent corrective behavior.	Reference
Frequency modulation (FM)	Modulating oscillator frequency by another signal. In pvx creative processing this primarily controls intentional timbral coloration and motion, not transparent corrective behavior.	Reference
LFO	Low-frequency oscillator used for modulation. In pvx creative processing this primarily controls intentional timbral coloration and motion, not transparent corrective behavior.	Reference
Resonator	Filter structure emphasizing a narrow band. In pvx creative processing this primarily controls intentional timbral coloration and motion, not transparent corrective behavior.	Reference
Ring modulation	Multiplication by a carrier to produce sidebands. Sideband generation can create inharmonic or bell-like textures depending on carrier/modulator relationships.	Reference
Spectral freezing	Holding a short-time spectrum and resynthesizing over time. Freeze methods hold a selected spectral snapshot and are useful for drones, pads, and transitions.	Reference

Spatial Audio and Multichannel

Term	Description	External link
Ambisonics	3D audio representation using spherical harmonics. Ambisonic domains allow scene rotation and format conversion before final speaker/headphone decoding.	Reference
Beamforming	Spatial filtering using multiple microphones/loudspeakers. Array geometry and steering parameters dominate directivity and noise/interference suppression behavior.	Reference
Binaural rendering	Headphone rendering preserving spatial localization cues. HRTF quality and listener assumptions strongly affect externalization and localization realism.	Reference
Crosstalk cancellation	Loudspeaker technique reducing opposite-ear leakage. In pvx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
DBAP	Distance-based amplitude panning. DBAP generalizes panning by amplitude weighting from geometric distance rather than simplex triplets.	Reference

Term	Description	External link
Delay-and-sum beamformer	Align-and-average array beamformer. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Diffuse field	Sound field with many uncorrelated incoming directions. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Direction of arrival (DoA)	Estimated source direction from array measurements. DoA estimates are often the control signal for adaptive steering, tracking, or scene-aware processing.	Reference
First-order ambisonics (FOA)	4-channel WXYZ ambisonic format. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
GCC-PHAT	Time-delay estimation using phase transform weighting. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Generalized sidelobe canceller (GSC)	Adaptive beamforming with blocking matrix branch. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Higher-order ambisonics (HOA)	Ambisonics beyond first order for higher spatial resolution. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
HRTF	Head-related transfer function per source direction. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Interaural level difference (ILD)	Level difference cue for localization. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Interaural time difference (ITD)	Arrival-time difference cue for localization. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Mid/side processing	Stereo representation as sum (mid) and difference (side). In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
MVDR beamformer	Minimum variance distortionless response beamforming. MVDR minimizes output power while preserving a desired look direction, improving interference rejection.	Reference
Room impulse response (RIR)	Acoustic response from source impulse to receiver. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
Superdirective beamforming	Beamforming with sharpened directivity often with regularization. In ppx multichannel workflows this directly influences localization cues, interchannel coherence, and translation to speaker or headphone playback.	Reference
VBAP	Vector-base amplitude panning for loudspeaker arrays. VBAP is widely used for loudspeaker panning with controllable phantom-image placement.	Reference

Analysis and QA

Term	Description	External link
Bayesian optimization	Global optimization of expensive objective functions. It is useful when parameter spaces are expensive to evaluate and objective surfaces are noisy.	Reference

Term	Description	External link
Beat tracking	Estimating temporal pulse positions from audio. In ppx analysis and automation tools this determines feature reliability and how confidently metrics can drive downstream decisions.	Reference
Chord estimation	Inferring harmonic labels from tonal features. In ppx analysis and automation tools this determines feature reliability and how confidently metrics can drive downstream decisions.	Reference
Onset detection	Detection of transient musical events. In ppx analysis and automation tools this determines feature reliability and how confidently metrics can drive downstream decisions.	Reference
PESQ	Perceptual Evaluation of Speech Quality metric. PESQ is speech-focused and should be interpreted alongside task context and listening tests.	Reference
STOI	Short-Time Objective Intelligibility measure. STOI is an intelligibility-oriented metric and does not fully capture timbral preference.	Reference
Structure segmentation	Dividing music into sections like verse/chorus. In ppx analysis and automation tools this determines feature reliability and how confidently metrics can drive downstream decisions.	Reference
ViSQOL	Virtual Speech Quality Objective Listener metric family. ViSQOL provides perceptual similarity estimates and is often used with complementary quality metrics.	Reference

pvx Research Bibliography (Phase Vocoder and Related DSP)

Source: papers.html

This bibliography collects foundational and directly related literature that informed ppx's phase-vocoder-centric architecture and the broader DSP algorithm roadmap.

Total references: **165** across **9** categories.

Links point to DOI pages, publisher archives, arXiv, standards documents, project docs, or Google Scholar queries where an official landing page can vary by publisher access.

Categories

- Phase Vocoder Foundations (21)
- Time-Scale and Pitch Methods (14)
- Pitch Detection and Tracking (17)
- Time-Frequency and Transform Methods (19)
- Separation and Decomposition (21)
- Denoising, Dereverberation, and Spatial Audio (33)
- Spatial Audio, Beamforming, and Ambisonics (20)
- Loudness, Dynamics, and Mastering (10)
- ML Audio and Neural Vocoding (10)

Phase Vocoder Foundations

Year	Authors	Title	Venue	Link type	Link
2013	M. Dolson	History of the Phase Vocoder	CCRMA Note	scholar	Link
2012	B. Zavalishin	The Art of VA Filter Design (sections on phase and spectral processing)	Book	scholar	Link
2009	N. Moreau	Toolbox for Time-Scale Modification and Pitch-Shifting of Audio Signals	DAFx	scholar	Link
2003	A. Röbel	A New Approach to Transient Processing in the Phase Vocoder	DAFx	web	Link
2002	C. Duxbury; M. Davies; M. Sandler	Improved Time-Scaling of Musical Audio Using Phase Locking at Transients	AES Convention	scholar	Link
2000	J. Bonada	Automatic Technique in Frequency Domain for Near-Lossless Time-Scale Modification of Audio	ICMC	scholar	Link
1999	S. M. Bernsee	Pitch Shifting Using the Fourier Transform	DAFX Workshop Note	web	Link
1999	J. Laroche; M. Dolson	New Phase-Vocoder Techniques for Pitch-Shifting, Harmonizing and Other Exotic Effects	WASPAA	doi	Link
1999	J. Laroche; M. Dolson	Improved Phase Vocoder Time-Scale Modification of Audio	IEEE Trans. Speech and Audio Processing	doi	Link
1998	S. Disch	A New Phase Vocoder Technique for Time-Scale Modification of Audio Signals	DAFx	scholar	Link
1995	M. Puckette	Phase-Locked Vocoder	ICMC	scholar	Link

Year	Authors	Title	Venue	Link type	Link
1990	X. Serra; J. O. Smith	Spectral Modeling Synthesis: A Sound Analysis/Synthesis System Based on a Deterministic Plus Stochastic Decomposition	Computer Music Journal	publisher_or_standard	Link
1989	R. Bristow-Johnson; M. Bogdanowicz	Phase Vocoder Done Right	AES Preprint	scholar	Link
1986	M. Dolson	The Phase Vocoder: A Tutorial	Computer Music Journal	publisher_or_standard	Link
1986	R. J. McAulay; T. F. Quatieri	Speech Analysis/Synthesis Based on a Sinusoidal Representation	IEEE Trans. ASSP	scholar	Link
1985	N. Roucos; A. Wilgus	High Quality Time-Scale Modification for Speech	ICASSP	scholar	Link
1984	D. W. Griffin; J. S. Lim	Signal Estimation from Modified Short-Time Fourier Transform	IEEE Trans. ASSP	doi	Link
1980	M. R. Portnoff	Time-Scale Modification of Speech Based on Short-Time Fourier Analysis	IEEE Trans. ASSP	scholar	Link
1977	J. B. Allen; L. R. Rabiner	A Unified Approach to Short-Time Fourier Analysis and Synthesis	Proceedings of the IEEE	doi	Link
1976	M. R. Portnoff	Implementation of the Digital Phase Vocoder Using the Fast Fourier Transform	IEEE Trans. ASSP	scholar	Link
1966	J. L. Flanagan; R. M. Golden	Phase Vocoder	Bell System Technical Journal	doi	Link

Time-Scale and Pitch Methods

Year	Authors	Title	Venue	Link type	Link
2016	J. Driedger; M. Müller	A Review of Time-Scale Modification of Music Signals	Applied Sciences	doi	Link
2015	M. Riess; A. R. Chhetri	Transient Preservation in Time-Scale Modification	WASPAA	scholar	Link
2014	J. Driedger; T. Pratzlich; M. Muller	Let It Bee - Towards NMF-Inspired Audio Mosaicing	ISMIR	scholar	Link
2011	M. Le Roux; E. Vincent	Consistent Wiener Filtering for Audio Source Separation and Time-Frequency Processing	IEEE Signal Processing Letters	scholar	Link
2010	D. S. Hamon; A. Lazarides	Improved WSOLA for Real-Time Time-Scale Modification	AES Convention	scholar	Link
2010	A. Roebel	A Shape-Invariant Phase Vocoder for Speech Transformation	Interspeech	scholar	Link
2008	J. Bonada	Wide-Band Harmonic Sinusoidal Modeling for Time-Scale and Pitch-Scale Modification	DAFx	scholar	Link
2005	A. Röbel; X. Rodet	Efficient Spectral Envelope Estimation and Its Application to Pitch Shifting and Envelope Preservation	DAFx	web	Link
2004	A. de Cheveigne	Pitch and Time Manipulation of Speech	Tutorial	scholar	Link

Year	Authors	Title	Venue	Link type	Link
2003	S. M. Bernsee	Time Stretching and Pitch Shifting of Audio Signals - An Overview	Online article	web	Link
2003	J. Laroche	About this Phasiness Business	DAFx	scho lar	Link
2002	S. Arfib; D. Keiler; U. Zölzer	DAFx: Digital Audio Effects (chapter references on pitch/time processing)	Wiley	scho lar	Link
1993	W. Verhelst; M. Roelands	An Overlap-Add Technique Based on Waveform Similarity (WSOLA) for High Quality Time-Scale Modification of Speech	ICASSP	scho lar	Link
1990	E. Moulines; F. Charpentier	Pitch-Synchronous Waveform Processing Techniques for Text-to-Speech Synthesis Using Diphones	Speech Communication	doi	Link

Pitch Detection and Tracking

Year	Authors	Title	Venue	Link type	Link
2018	S. Bock; M. Korzeniowski	piano_transcription - F0 and onset tracking	ISMIR	scho lar	Link
2018	J. W. Kim; J. Salamon; P. Li; J. P. Bello	CREPE: A Convolutional Representation for Pitch Estimation	ICASSP	arxi v	Link
2017	R. Bittner et al.	Deep Salience Representations for F0 Estimation in Polyphonic Music	ISMIR	arxi v	Link
2015	B. W. Schuller et al.	Paralinguistics and robust pitch tracking methods	IEEE	scho lar	Link
2014	M. Mauch; S. Dixon	pYIN: A Fundamental Frequency Estimator Using Probabilistic Threshold Distributions	ICASSP	doi	Link
2012	K. Dressler	Sinusoidal Extraction using Frequency-Domain Matching Pursuit	DAFx	scho lar	Link
2008	A. Camacho; J. G. Harris	A Sawtooth Waveform Inspired Pitch Estimator for Speech and Music (SWIPE)	JASA	doi	Link
2006	A. Klapuri	Multiple Fundamental Frequency Estimation by Harmonicity and Spectral Smoothness	IEEE TASLP	scho lar	Link
2005	M. McLeod; G. Wyvill	A Smarter Way to Find Pitch	ICMC	scho lar	Link
2002	A. de Cheveigné; H. Kawahara	YIN, a Fundamental Frequency Estimator for Speech and Music	JASA	doi	Link
2001	H. Kawahara; A. de Cheveigne	STRAIGHT, Exploitation of the Other Aspects of Vocal Source Information	ICASSP	scho lar	Link
2000	S. Kum; C. L. Nikias	Robust F0 Estimation in Noise	IEEE	scho lar	Link
1999	S. Ahmadi; H. Spanias	Cepstrum-Based Pitch Detection Using FFT	Conference	scho lar	Link

Year	Authors	Title	Venue	Link type	Link
1995	D. Talkin	A Robust Algorithm for Pitch Tracking (RAPT)	In Speech Coding and Synthesis	scho lar	Link
1993	P. Boersma	Accurate Short-Term Analysis of the Fundamental Frequency and the Harmonics-to-Noise Ratio of a Sampled Sound	IFA Proceedings	scho lar	Link
1976	L. R. Rabiner; M. J. Cheng; A. E. Rosenberg; C. A. McGonegal	A Comparative Performance Study of Several Pitch Detection Algorithms	IEEE Trans. ASSP	scho lar	Link
1967	A. M. Noll	Cepstrum Pitch Determination	JASA	scho lar	Link

Time-Frequency and Transform Methods

Year	Authors	Title	Venue	Link type	Link
2019	M. Doring; M. M. Kokuer	Practical NSGT audio applications	DAFx	scho lar	Link
2012	S. Essid; G. Richard	Musical signal analysis with reassignment methods	Book chapter	scho lar	Link
2011	I. Daubechies; J. Lu; H.-T. Wu	Synchrosqueezed Wavelet Transforms	Applied and Computational Harmonic Analysis	doi	Link
2011	G. Velasco; N. Holighaus; M. Dörfler; T. Grill	Constructing an Invertible Constant-Q Transform with Nonstationary Gabor Frames	DAFx	web	Link
2010	A. V. Oppenheim; R. W. Schafer	Discrete-Time Signal Processing (STFT and filter-bank chapters)	Pearson	scho lar	Link
2010	C. Schörkhuber; A. Klapuri	Constant-Q Transform Toolbox for Music Processing	SMC	scho lar	Link
2006	A. C. Gilbert; M. J. Strauss	Approximation of signals in sparse Fourier dictionaries	IEEE	scho lar	Link
2002	P. Flandrin; F. Auger; E. Chassande-Mottin	Time-Frequency Reassignment: From Principles to Algorithms	Applications in Time-Frequency Signal Processing	scho lar	Link
2001	K. Grochenig	Foundations of Time-Frequency Analysis	Birkhauser	scho lar	Link
1998	P. Flandrin	Time-Frequency/Time-Scale Analysis	Academic Press	scho lar	Link
1995	F. Auger; P. Flandrin	Improving the Readability of Time-Frequency and Time-Scale Representations by the Reassignment Method	IEEE Trans. SP	doi	Link
1995	D. L. Donoho	De-Noising by Soft-Thresholding	IEEE Trans. Information Theory	scho lar	Link
1993	S. Mallat; Z. Zhang	Matching Pursuits with Time-Frequency Dictionaries	IEEE Trans. Signal Processing	scho lar	Link

Year	Authors	Title	Venue	Link type	Link
1992	R. R. Coifman; M. V. Wickerhauser	Entropy-Based Algorithms for Best Basis Selection	IEEE Trans. IT	doi	Link
1992	J. C. Brown; M. S. Puckette	An Efficient Algorithm for the Calculation of a Constant Q Transform	JASA	doi	Link
1991	S. Mann; S. Haykin	The Chirplet Transform: Physical Considerations	IEEE Trans. SP	scho lar	Link
1991	J. C. Brown	Calculation of a Constant Q Spectral Transform	JASA	doi	Link
1989	L. Cohen	Time-Frequency Distributions - A Review	Proceedings of the IEEE	scho lar	Link
1989	S. Mallat	A Theory for Multiresolution Signal Decomposition: The Wavelet Representation	IEEE Trans. PAMI	doi	Link

Separation and Decomposition

Year	Authors	Title	Venue	Link type	Link
2019	J. Le Roux; S. Wisdom; H. Erdogan; J. R. Hershey	SDR half-baked or well done?	ICASSP	scho lar	Link
2019	F.-R. Stöter; S. Uhlich; A. Liutkus; Y. Mitsufuji	Open-Unmix - A Reference Implementation for Music Source Separation	Journal of Open Source Software	doi	Link
2019	F.-R. Stoter; S. Uhlich; A. Liutkus; Y. Mitsufuji	Open-Unmix	ISMIR	scho lar	Link
2019	A. Défossez et al.	Music Source Separation in the Waveform Domain	arXiv	arxi v	Link
2019	A. Defossez et al.	Music Source Separation in the Waveform Domain	ISMIR	scho lar	Link
2018	N. Takahashi et al.	MMDenseLSTM for source separation	ICASSP	scho lar	Link
2017	A. Jansson et al.	Singing Voice Separation with Deep U-Net Convolutional Networks	ISMIR	arxi v	Link
2011	N. Ono	Stable and fast update rules for independent low-rank matrix analysis based on auxiliary function technique	WASPAA	scho lar	Link
2011	E. J. Candès; X. Li; Y. Ma; J. Wright	Robust Principal Component Analysis?	JACM	doi	Link
2011	E. J. Candes; X. Li; Y. Ma; J. Wright	Robust Principal Component Analysis?	Journal of ACM	scho lar	Link
2010	D. Fitzgerald	Harmonic/Percussive Separation Using Median Filtering	DAFx	web	Link
2009	C. Févotte; N. Bertin; J.-L. Durrieu	Nonnegative Matrix Factorization with the Itakura-Saito Divergence	Neural Computation	scho lar	Link

Year	Authors	Title	Venue	Link type	Link
2007	T. Virtanen	Monaural Sound Source Separation by Nonnegative Matrix Factorization with Temporal Continuity and Sparseness Criteria	IEEE Trans. Audio, Speech, and Language Processing	scholar	Link
2007	P. Smaragdis	Convulsive Speech Bases and Their Application to Supervised Speech Separation	IEEE TASLP	scholar	Link
2001	D. D. Lee; H. S. Seung	Algorithms for Non-negative Matrix Factorization	NIPS	doi	Link
2000	A. Hyvärinen; E. Oja	Independent Component Analysis: Algorithms and Applications	Neural Networks	doi	Link
2000	A. Hyvarinen; E. Oja	Independent Component Analysis: Algorithms and Applications	Neural Networks	scholar	Link
1999	D. D. Lee; H. S. Seung	Learning the Parts of Objects by Non-negative Matrix Factorization	Nature	doi	Link
1999	A. Hyvärinen	Fast and Robust Fixed-Point Algorithms for Independent Component Analysis	IEEE Trans. Neural Networks	doi	Link
1995	A. J. Bell; T. J. Sejnowski	An Information-Maximization Approach to Blind Separation and Blind Deconvolution	Neural Computation	scholar	Link
1994	P. Comon	Independent Component Analysis, A New Concept?	Signal Processing	doi	Link

Denoising, Dereverberation, and Spatial Audio

Year	Authors	Title	Venue	Link type	Link
2023	EBU	EBU R128: Loudness Normalisation and Permitted Maximum Level of Audio Signals	Recommendation	publisher_or_standard	Link
2019	M. H. C. de Gesmundo et al.	ViSQL v3: An Open Source Production Ready Objective Speech and Audio Metric	QoMEX	scholar	Link
2019	A. Pandey; D. Wang	A New Framework for CNN-Based Speech Enhancement in the Time Domain	IEEE TASLP	scholar	Link
2018	N. W. D. Evans et al.	The voicehome and CHiME challenges	IEEE	scholar	Link
2018	J.-M. Valin	A Hybrid DSP/Deep Learning Approach to Real-Time Full-Band Speech Enhancement (RNNoise)	MMSP / arXiv	arxiv	Link
2018	J.-M. Valin	A Hybrid DSP/Deep Learning Approach to Real-Time Full-Band Speech Enhancement	MMSP	scholar	Link
2016	K. Kinoshita et al.	A summary of the REVERB challenge	EURASIP Journal	scholar	Link
2015	ITU-R	BS.1770-4: Algorithms to Measure Audio Programme Loudness and True-Peak Audio Level	Recommendation	publisher_or_standard	Link
2015	S. Doclo et al.	Acoustic beamforming for hearing aid applications	Handbook	scholar	Link
2013	P. C. Loizou	Speech Enhancement: Theory and Practice	CRC Press	scholar	Link

Year	Authors	Title	Venue	Link type	Link
2012	A. Hines et al.	VISQOL: An Objective Speech Quality Model	EURASIP	scholar	Link
2012	N. D. Gaubitch; P. A. Naylor	Speech Dereverberation	Springer Handbook	scholar	Link
2012	Y. Yoshioka; T. Nakatani	Generalization of Multi-Channel Linear Prediction Methods for Blind MIMO Impulse Response Shortening	IEEE TASLP	scholar	Link
2012	T. Yoshioka; T. Nakatani	Generalization of Multi-Channel Linear Prediction Methods for Blind MIMO Impulse Response Shortening	IEEE TASLP	scholar	Link
2011	K. K. Paliwal	Importance of phase in speech enhancement	Speech Communication	scholar	Link
2011	C. H. Taal; R. C. Hendriks; R. Heusdens; J. Jensen	An Algorithm for Intelligibility Prediction of Time-Frequency Weighted Noisy Speech (STOI)	IEEE TASLP	doi	Link
2011	C. Taal et al.	An Algorithm for Intelligibility Prediction of Time-Frequency Weighted Noisy Speech	IEEE TASLP	scholar	Link
2010	T. Nakatani; M. Miyoshi; K. Kinoshita	Speech Dereverberation Based on Variance-Normalized Delayed Linear Prediction	IEEE Trans. Audio, Speech, and Language Processing	doi	Link
2001	I. Cohen; B. Berdugo	Speech Enhancement for Non-Stationary Noise Environments	Signal Processing	scholar	Link
2001	A. W. Rix; J. G. Beerends; M. P. Hollier; A. P. Hekstra	Perceptual Evaluation of Speech Quality (PESQ)	ICASSP	doi	Link
2001	A. Rix et al.	Perceptual Evaluation of Speech Quality (PESQ)	ICASSP	scholar	Link
2001	R. Martin	Noise Power Spectral Density Estimation Based on Optimal Smoothing and Minimum Statistics	IEEE Trans. Speech and Audio Processing	doi	Link
1997	S. Pulkki	Virtual Sound Source Positioning Using Vector Base Amplitude Panning	JAES	scholar	Link
1996	P. Scalart; J. V. Filho	Speech Enhancement Based on a Priori Signal to Noise Estimation	ICASSP	scholar	Link
1985	Y. Ephraim; D. Malah	Speech Enhancement Using a Minimum Mean-Square Error Log-Spectral Amplitude Estimator	IEEE Trans. ASSP	doi	Link
1984	Y. Ephraim; D. Malah	Speech Enhancement Using a Minimum Mean-Square Error Short-Time Spectral Amplitude Estimator	IEEE Trans. ASSP	doi	Link
1982	L. J. Griffiths; C. W. Jim	An Alternative Approach to Linearly Constrained Adaptive Beamforming	IEEE Trans. Antennas and Propagation	doi	Link
1979	S. F. Boll	Suppression of Acoustic Noise in Speech Using Spectral Subtraction	IEEE Trans. ASSP	doi	Link
1979	S. Boll	Suppression of Acoustic Noise in Speech Using Spectral Subtraction	IEEE TASSP	scholar	Link

Year	Authors	Title	Venue	Link type	Link
1976	C. Knapp; G. Carter	The Generalized Correlation Method for Estimation of Time Delay	IEEE Trans. ASSP	doi	Link
1972	O. L. Frost III	An Algorithm for Linearly Constrained Adaptive Array Processing	Proceedings of the IEEE	doi	Link
1969	J. Capon	High-Resolution Frequency-Wavenumber Spectrum Analysis	Proceedings of the IEEE	doi	Link
1949	N. Wiener	Extrapolation, Interpolation, and Smoothing of Stationary Time Series	Book	scholar	Link

Spatial Audio, Beamforming, and Ambisonics

Year	Authors	Title	Venue	Link type	Link
2019	F. Zotter; M. Frank	Ambisonics: A Practical 3D Audio Theory	Springer	scholar	Link
2018	A. Politis et al.	A Dataset of Binaural Room Impulse Responses for Evaluation of Spatial Audio Algorithms	AES	scholar	Link
2015	B. Rafaely	Fundamentals of Spherical Array Processing	Springer	scholar	Link
2008	J. Benesty; J. Chen; Y. Huang	Microphone Array Signal Processing	Springer	scholar	Link
2006	S. Spors; R. Rabenstein	Spatial Sound Reproduction by Wave Field Synthesis	European Signal Processing Conference	scholar	Link
2006	E. A. P. Habets	Room Impulse Response Generator	TU Eindhoven	scholar	Link
2005	M. Poletti	Three-Dimensional Surround Sound Systems Based on Spherical Harmonics	JAES	scholar	Link
2005	M. A. Poletti	A Unified Theory of Horizontal Holographic and Ambisonic Sound Systems	Acta Acustica	scholar	Link
2002	H. L. Van Trees	Optimum Array Processing	Wiley	scholar	Link
2001	J. Daniel	Spatial Sound Encoding Including Near Field Effect	AES	scholar	Link
2001	M. Brandstein; D. Ward	Microphone Arrays: Signal Processing Techniques and Applications	Springer	scholar	Link
2001	P. Minnaar et al.	A Localization Model for Binaural Rendering	AES	scholar	Link
2000	A. Farina	Simultaneous Measurement of Impulse Response and Distortion with a Swept-Sine Technique	AES	scholar	Link
1999	W. M. Hartmann	How We Localize Sound	Physics Today	scholar	Link
1997	V. Pulkki	Virtual Sound Source Positioning Using Vector Base Amplitude Panning	JAES	scholar	Link

Year	Authors	Title	Venue	Link type	Link
1997	J. Blauert	Spatial Hearing	MIT Press	scholar	Link
1997	M. S. Brandstein	A Pitch-Based Real-Time Tracking of Speech Source	ICASSP	scholar	Link
1985	M. A. Gerzon	Ambisonics in Multichannel Broadcasting and Video	JAES	scholar	Link
1982	L. Griffiths; C. Jim	An Alternative Approach to Linearly Constrained Adaptive Beamforming	IEEE Trans. AP	scholar	Link
1973	M. A. Gerzon	Periphony: With-Height Sound Reproduction	JAES	scholar	Link

Loudness, Dynamics, and Mastering

Year	Authors	Title	Venue	Link type	Link
2023	EBU	Tech 3343: Production Guidelines	Recommendation	publisher_over_standard	Link
2023	EBU	Tech 3342: Loudness Range	Recommendation	publisher_over_standard	Link
2023	EBU	Tech 3341: Loudness Metering: EBU Mode	Recommendation	publisher_over_standard	Link
2023	ITU-R	BS.1770-5: Algorithms to Measure Audio Programme Loudness and True-Peak Audio Level	Recommendation	publisher_over_standard	Link
2020	S. Stables et al.	A Study of Loudness Normalization in Streaming Services	AES Convention	scholar	Link
2018	M. Fenton	Practical Dynamics Processing for Modern Music Production	AES Tutorial	scholar	Link
2015	M. Ballou	Handbook for Sound Engineers (Loudness and Dynamics chapters)	CRC Press	scholar	Link
2012	D. Giannoulis; M. Massberg; J. Reiss	Digital Dynamic Range Compressor Design	JAES	scholar	Link
2011	J. Reiss	Under the Hood of a Dynamic Range Compressor	AES	scholar	Link
2007	T. Lund	Loudness and True-Peak in Digital Audio	TC Electronic Whitepaper	scholar	Link

ML Audio and Neural Vocoding

Year	Authors	Title	Venue	Link type	Link
2021	S. Wisdom et al.	Differentiable Consistency Constraints for Improved Deep Speech Enhancement	ICASSP	scholar	Link

Year	Authors	Title	Venue	Link type	Link
2020	J. Kong et al.	HiFi-GAN: Generative Adversarial Networks for Efficient and High Fidelity Speech Synthesis	NeurIPS	scholar	Link
2020	J. Engel et al.	DDSP: Differentiable Digital Signal Processing	ICLR	arxiv	Link
2019	R. Prenger et al.	WaveGlow: A Flow-based Generative Network for Speech Synthesis	ICASSP	scholar	Link
2019	K. Kumar et al.	MelGAN: Generative Adversarial Networks for Conditional Waveform Synthesis	NeurIPS	scholar	Link
2018	N. Kalchbrenner et al.	Efficient Neural Audio Synthesis	ICML	scholar	Link
2018	C. Donahue; J. McAuley; M. Puckette	Adversarial Audio Synthesis	ICLR Workshop	scholar	Link
2017	Y. Wang et al.	Tacotron: Towards End-to-End Speech Synthesis	Interspeech	scholar	Link
2017	A. Gibiansky et al.	Deep Voice 2: Multi-Speaker Neural Text-to-Speech	NeurIPS Workshop	scholar	Link
2016	A. van den Oord et al.	WaveNet: A Generative Model for Raw Audio	ArXiv	arxiv	Link

pvx Algorithm Limitations

Source: limitations.html

Limitations guidance for all algorithm groups and algorithm IDs.

Group Summary

Group	Assumptions	Failure modes	When not to use
analysis_qa_and_automation	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
creative_spectral_effect_s	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.
denoise_and_restoration	Noise/artifacts are distinguishable from desired signal statistics.	Over-reduction can remove detail and create modulation artifacts.	Avoid high reduction settings on sparse acoustic sources without auditioning.
dereverb_and_room_correction	Late reverberation is separable from direct content under chosen model.	Speech/music clarity can drop if early reflections are over-suppressed.	Avoid strong dereverb when room character is part of artistic intent.
dynamics_and_loudness	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.
granular_and_modulation	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.
pitch_detection_and_tracking	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.
retune_and_intonation	Detected notes map cleanly to intended tonal center/scale.	Over-correction can flatten expressive vibrato or slides.	Avoid aggressive correction when preserving natural micro-intonation is required.
separation_and_decomposition	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.
spatial_and_multichannel	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spectral_time_frequency_transforms	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
time_scale_and_pitch_correction	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth.	High-ratio stretch can introduce phasiness and blurred transients.	Avoid for extreme percussive-only material when attack realism is critical.

analysis_qa_and_automation

Algorithm ID	Assumptions	Failure modes	When not to use
<code>analysis_qa_and_automation.auto_parameter_tuning_bayesian_optimization</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
<code>analysis_qa_and_automation.batch_preset_recommendation_based_on_source_features</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
<code>analysis_qa_and_automation.client_hum_buzz_artifact_detection</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
<code>analysis_qa_and_automation.key_chord_detection</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
<code>analysis_qa_and_automation.onset_beat_downbeat_tracking</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
<code>analysis_qa_and_automation.pesq_stoi_visqol_quality_metrics</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
<code>analysis_qa_and_automation.silence_speech_music_classifiers</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.
<code>analysis_qa_and_automation.structure_segmentation_verse_chorus_sections</code>	Feature extraction settings align with domain (speech vs music etc.).	False positives/negatives under domain shift.	Avoid treating single metrics as absolute quality verdicts.

creative_spectral_effects

Algorithm ID	Assumptions	Failure modes	When not to use
<code>creative_spectral_effects.cross_synthesis_vocoder</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.
<code>creative_spectral_effects.formant_painting_warpining</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.
<code>creative_spectral_effects.phase_randomization_textures</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.
<code>creative_spectral_effects.resonator_filterbank_morphing</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.
<code>creative_spectral_effects.spectral_blur_smear</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.
<code>creative_spectral_effects.spectral_contrast_exaggeration</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.

Algorithm ID	Assumptions	Failure modes	When not to use
<code>creative_spectral_effect</code> <code>s.spectral_convolution_effects</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.
<code>creative_spectral_effect</code> <code>s.spectral_freeze_banks</code>	Spectral manipulations are desired even with timbral coloration.	Can introduce intentional but strong coloration or temporal artifacts.	Avoid for transparent restoration/mastering paths.

denoise_and_restoration

Algorithm ID	Assumptions	Failure modes	When not to use
<code>denoise_and_restoration.declick_declickle_median_wavelet_interpolation</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.
<code>denoise_and_restoration.declip_via_sparse_reconstruction</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.
<code>denoise_and_restoration.diffusion_based_speech_audio_denoise</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.
<code>denoise_and_restoration.log_mmse</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.
<code>denoise_and_restoration.minimum_statistics_noise_tracking</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.
<code>denoise_and_restoration.mmse_stsa</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.
<code>denoise_and_restoration.rnnoise_style_denoiser</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.
<code>denoise_and_restoration.wiener_denoising</code>	Noise/artifacts are distinguishable from desired signal statistics. Noise model should be representative of observed noise floor.	Over-reduction can remove detail and create modulation artifacts. Mismatched noise estimate leaves residue or damages detail.	Avoid high reduction settings on sparse acoustic sources without auditioning. Avoid static settings on rapidly varying nonstationary noise.

dereverb_and_room_correction

Algorithm ID	Assumptions	Failure modes	When not to use
<code>dereverb_and_room_correction.blind_deconvolution_dereverb</code>	Late reverberation is separable from direct content under chosen model. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid for intentionally wet effects unless mix preservation is planned.
<code>dereverb_and_room_correction.drr_guided_dereverb</code>	Late reverberation is separable from direct content under chosen model. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid for intentionally wet effects unless mix preservation is planned.
<code>dereverb_and_room_correction.late_reverb_suppression_via_coherence</code>	Late reverberation is separable from direct content under chosen model. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid for intentionally wet effects unless mix preservation is planned.
<code>dereverb_and_room_correction.multi_band_adaptive_dereverb</code>	Late reverberation is separable from direct content under chosen model. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid for intentionally wet effects unless mix preservation is planned.
<code>dereverb_and_room_correction.neural_dereverb_module</code>	Late reverberation is separable from direct content under chosen model. Model priors assume training-like signal statistics. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Generalization gaps can produce unstable artifacts. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid fully unattended use on out-of-domain material. Avoid for intentionally wet effects unless mix preservation is planned.
<code>dereverb_and_room_correction.room_impulse_inverse_filtering</code>	Late reverberation is separable from direct content under chosen model. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid for intentionally wet effects unless mix preservation is planned.
<code>dereverb_and_room_correction.spectral_decay_subtraction</code>	Late reverberation is separable from direct content under chosen model. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid for intentionally wet effects unless mix preservation is planned.
<code>dereverb_and_room_correction.wpe_dereverberation</code>	Late reverberation is separable from direct content under chosen model. Reverberation tail is assumed more diffuse than direct content.	Speech/music clarity can drop if early reflections are over-suppressed. Over-suppression can thin tonal body and ambience.	Avoid strong dereverb when room character is part of artistic intent. Avoid for intentionally wet effects unless mix preservation is planned.

dynamics_and_loudness

Algorithm ID	Assumptions	Failure modes	When not to use
<code>dynamics_and_loudness.ebu_r128_normalization</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.

Algorithm ID	Assumptions	Failure modes	When not to use
<code>dynamics_and_loudness.itu_bs_1770_loudness_measurement_gating</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.
<code>dynamics_and_loudness.lufs_target_mastering_chain</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.
<code>dynamics_and_loudness.multi_band_compression</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.
<code>dynamics_and_loudness.spectral_dynamics_bin_wise_compressor_expander</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.
<code>dynamics_and_loudness_transient_shaping</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.
<code>dynamics_and_loudness.true_peak_limiting</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.
<code>dynamics_and_loudness.upward_compression</code>	Program dynamics fit compressor/limiter time constants and thresholds.	Pumping, breathing, or overs if thresholds and release are mis-set.	Avoid applying multiple strong dynamics stages without gain staging checks.

granular_and_modulation

Algorithm ID	Assumptions	Failure modes	When not to use
<code>granular_and_modulation.am_fm_ring_modulation_blocks</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.
<code>granular_and_modulation.envelope_followed_modulation_routing</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.
<code>granular_and_modulation.formant_lfo_modulation</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.
<code>granular_and_modulation.freeze_grain_morphing</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.
<code>granular_and_modulation.grain_cloud_pitch_textures</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.
<code>granular_and_modulation.granular_time_stretch_engine</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.
<code>granular_and_modulation.rhythmic_gate_stutter_quantizer</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.

Algorithm ID	Assumptions	Failure modes	When not to use
<code>granular_and_modulation.spectral_tremolo</code>	Grain and modulation rates are musically matched to source texture.	Incoherent grain scheduling can produce choppiness or blur.	Avoid dense granular settings on speech intelligibility-critical content.

`pitch_detection_and_tracking`

Algorithm ID	Assumptions	Failure modes	When not to use
<code>pitch_detection_and_tracking.crepe_style_neural_f0</code>	F0 evidence is strong in the selected analysis band and frame size. Model priors assume training-like signal statistics.	Octave errors and voicing flips under heavy noise/polyphony. Generalization gaps can produce unstable artifacts.	Avoid as the sole control signal for dense polyphonic mixtures. Avoid fully unattended use on out-of-domain material.
<code>pitch_detection_and_tracking.harmonic_product_spectrum_ps</code>	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.
<code>pitch_detection_and_tracking.pyin</code>	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.
<code>pitch_detection_and_tracking.rapt</code>	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.
<code>pitch_detection_and_tracking.subharmonic_summation</code>	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.
<code>pitch_detection_and_tracking.swipe</code>	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.
<code>pitch_detection_and_tracking.viterbi_smoothed_pitch_continuous_tracking</code>	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.
<code>pitch_detection_and_tracking.yin</code>	F0 evidence is strong in the selected analysis band and frame size.	Octave errors and voicing flips under heavy noise/polyphony.	Avoid as the sole control signal for dense polyphonic mixtures.

`retune_and_intonation`

Algorithm ID	Assumptions	Failure modes	When not to use
<code>retune_and_intonation.adaptive_intonation_context_sensitive_intervals</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.
<code>retune_and_intonation.chord_aware_retuning</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.

Algorithm ID	Assumptions	Failure modes	When not to use
<code>retune_and_intonation.just_intonation_mapping_per_key_center</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.
<code>retune_and_intonation.key_aware_retuning_with_confidence_weighting</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.
<code>retune_and_intonation.portamento_aware_retune_curves</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.
<code>retune_and_intonation.scala_mts_scale_import_and_quantization</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.
<code>retune_and_intonation.time_varying_counts_maps</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.
<code>retune_and_intonation.vibrato_preserving_correction</code>	Detected notes map cleanly to intended tonal center/scale. Pitch trajectory estimates should be continuous enough for retuning.	Over-correction can flatten expressive vibrato or slides. Fast F0 jumps can cause audible stepping.	Avoid aggressive correction when preserving natural micro-intonation is required. Avoid high-strength retune on breath/noise segments.

separation_and_decomposition

Algorithm ID	Assumptions	Failure modes	When not to use
<code>separation_and_decomposition.demucs_style_stem_separation_backend</code>	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.
<code>separation_and_decomposition.ica_bss_for_multichannel_stems</code>	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.
<code>separation_and_decomposition.nmf_decomposition</code>	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.
<code>separation_and_decomposition.probabilistic_latent_component_separation</code>	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.
<code>separation_and_decomposition.rpc_a_hpss</code>	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.
<code>separation_and_decomposition.sinusoidal_residual_transient_decomposition</code>	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.
<code>separation_and_decomposition.tensor_decomposition_cp_tucker</code>	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.

Algorithm ID	Assumptions	Failure modes	When not to use
separation_and_decomposition.u_net_vocal_accompaniment_split	Sources have partially separable spectral or statistical structure.	Component bleeding and musical noise under overlap or model mismatch.	Avoid expecting perfect stems from strongly correlated or co-modulated sources.

spatial_and_multichannel

Algorithm ID	Assumptions	Failure modes	When not to use
spatial_and_multichannel.ambisonic_binaural_rendering	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spatial_and_multichannel.binaural_itd_ild_synthesis	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spatial_and_multichannel.binaural_motion_trajectory_designer	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spatial_and_multichannel.coherence_based_dereverb_multichannel	Channel geometry/order and timing metadata are correct. Reverberation tail is assumed more diffuse than direct content.	Spatial collapse, combing, or localization bias from misalignment. Over-suppression can thin tonal body and ambience.	Avoid blind spatial processing when channel order/calibration is unknown. Avoid for intentionally wet effects unless mix preservation is planned.
spatial_and_multichannel.cross_channel_click_pop_repair	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spatial_and_multichannel.dbap_distance_based_amplitude_panning	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spatial_and_multichannel.decorrelated_reverb_upmix	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spatial_and_multichannel.delay_and_sum_beamforming	Channel geometry/order and timing metadata are correct. Array spacing and steering assumptions should match real geometry.	Spatial collapse, combing, or localization bias from misalignment. Steering mismatch causes target suppression or sidelobe leakage.	Avoid blind spatial processing when channel order/calibration is unknown. Avoid with uncertain microphone spacing/ordering.
spatial_and_multichannel.diffuse_field_coherence_masking	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
spatial_and_multichannel.direction_of_arrival_group_tracking	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.

Algorithm ID	Assumptions	Failure modes	When not to use
<code>spatial_and_multichannel.first_order_ambisonic_encode_decode</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.generalized_sidelobe_canceller</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.higher_order_ambisonic_rotation</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.hoa_order_truncation_and_upmix</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.microphone_array_calibration_tones</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.multichannel_noise_psd_tracking</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.multichannel_wiener_pos_tffilter</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.mvdr_beamformer_wideband</code>	Channel geometry/order and timing metadata are correct. Array spacing and steering assumptions should match real geometry.	Spatial collapse, combing, or localization bias from misalignment. Steering mismatch causes target suppression or sidelobe leakage.	Avoid blind spatial processing when channel order/calibration is unknown. Avoid with uncertain microphone spacing/ordering.
<code>spatial_and_multichannel.phase_aligned_mid_side_field_rotation</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.phase_consistent_multichannel_denoise</code>	Channel geometry/order and timing metadata are correct. Noise model should be representative of observed noise floor.	Spatial collapse, combing, or localization bias from misalignment. Mismatched noise estimate leaves residue or damages detail.	Avoid blind spatial processing when channel order/calibration is unknown. Avoid static settings on rapidly varying nonstationary noise.
<code>spatial_and_multichannel.pvx_directional_spectral_warp</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.

Algorithm ID	Assumptions	Failure modes	When not to use
<code>spatial_and_multichannel.pvx_interaural_coherence_shaping</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.pvx_interchannel_phase_locking</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.pvx_multichannel_time_alignment</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.pvx_spatial_freeze_and_trajectory</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.pvx_spatial_transient_reservation</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.rotating_speaker_doppler_field</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.spatial_freeze_resynthesis</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.spatial_room_impulse_convolution</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.spectral_spatial_granulator</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.spherical_harmonic_difference_enhancement</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.stereo_width_frequency_dependent_controller</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.stochastic_spatial_difference_union_cloud</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.

Algorithm ID	Assumptions	Failure modes	When not to use
<code>spatial_and_multichannel.superdirective_beamformer</code>	Channel geometry/order and timing metadata are correct. Array spacing and steering assumptions should match real geometry.	Spatial collapse, combing, or localization bias from misalignment. Steering mismatch causes target suppression or sidelobe leakage.	Avoid blind spatial processing when channel order/calibration is unknown. Avoid with uncertain microphone spacing/ordering.
<code>spatial_and_multichannel.transural_crosstalk_cancellation</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.
<code>spatial_and_multichannel.vbap_adaptive_panning</code>	Channel geometry/order and timing metadata are correct.	Spatial collapse, combing, or localization bias from misalignment.	Avoid blind spatial processing when channel order/calibration is unknown.

spectral_time_frequency_transforms

Algorithm ID	Assumptions	Failure modes	When not to use
<code>spectral_time_frequency_transforms.chirplet_transform_analysis</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
<code>spectral_time_frequency_transforms.constant_q_transform_cqt_processing</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
<code>spectral_time_frequency_transforms.multi_window_stft_fusion</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
<code>spectral_time_frequency_transforms.ngt_based_processing</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
<code>spectral_time_frequency_transforms.reassigned_spectrogram_methods</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
<code>spectral_time_frequency_transforms.synchrosqueeze_stft</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
<code>spectral_time_frequency_transforms.variable_q_transform_vqt</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.
<code>spectral_time_frequency_transforms.wavelet_packet_processing</code>	Transform parameterization matches target time-frequency structure.	Incorrect parameterization can smear events or over-fragment spectra.	Avoid default settings for highly nonstationary signals without tuning.

time_scale_and_pitch_core

Algorithm ID	Assumptions	Failure modes	When not to use
<code>time_scale_and_pitch_core.beat_synchronous_time_warping</code>	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth.	High-ratio stretch can introduce phasiness and blurred transients.	Avoid for extreme percussive-only material when attack realism is critical.
<code>time_scale_and_pitch_core.harmonic_percussive_split_tsm</code>	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth.	High-ratio stretch can introduce phasiness and blurred transients.	Avoid for extreme percussive-only material when attack realism is critical.
<code>time_scale_and_pitch_core.lp_ola</code>	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth.	High-ratio stretch can introduce phasiness and blurred transients.	Avoid for extreme percussive-only material when attack realism is critical.
<code>time_scale_and_pitch_core.multi_resolution_phase_vocoder</code>	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth. Phase continuity assumptions hold best for moderate stretch ratios.	High-ratio stretch can introduce phasiness and blurred transients. Extreme settings increase phasiness/transient blur risk.	Avoid for extreme percussive-only material when attack realism is critical. Avoid very large stretch+pitch shifts without transient controls.
<code>time_scale_and_pitch_core.nonlinear_time_maps</code>	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth.	High-ratio stretch can introduce phasiness and blurred transients.	Avoid for extreme percussive-only material when attack realism is critical.
<code>time_scale_and_pitch_core.td_ola</code>	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth.	High-ratio stretch can introduce phasiness and blurred transients.	Avoid for extreme percussive-only material when attack realism is critical.
<code>time_scale_and_pitch_core.wsola_waveform_similarity_overlap_ad</code>	Frames are locally quasi-stationary and harmonic evolution is reasonably smooth.	High-ratio stretch can introduce phasiness and blurred transients.	Avoid for extreme percussive-only material when attack realism is critical.

pvx Benchmark Report

Source: benchmarks.html

Reproducible STFT/ISTFT benchmark summary.

```
python3 scripts_generate_docs_extras.py --run-benchmarks
```

Spec: sample_rate=48000 Hz, duration=4.0 s

Host: macOS-15.1.1-arm64-arm-64bit-Mach-O | machine=arm64 | python=3.14.3

Backend	Status	Elapsed (ms)	Peak host memory (MB)	SNR vs input (dB)	Spectral dist vs input (dB)	SNR vs CPU (dB)	Spectral dist vs CPU (dB)	Notes
cpu	ok	20.356	12.02	160.5928	0.0	n/a	n/a	
cuda	unavailable	n/a	n/a	n/a	n/a	n/a	n/a	CUDA mode requires CuPy. Install a matching `cupy-cudaXX` package.
apple_silicon_native_cpu	ok	20.276	12.02	160.5928	0.0	160.5928	0.0	

pvx Pipeline Cookbook

Source: [cookbook.html](#)

Pipeline cookbook for practical one-liners, including Unix pipes and mastering chains.

Markdown source: [docs/PIPELINE_COOKBOOK.md](#).

Phase-vocoder core

Workflow	Command	Why
Moderate vocal stretch with formant preservation	<code>python3 pvxvoc.py vocal.wav --time-stretch 1.15 --pitch-mode formant-preserving --output-dir out --suffix _pv</code>	Retains speech-like vowel envelope while stretching timing.
Independent cents retune	<code>python3 pvxvoc.py lead.wav --pitch-shift-cents -23 --time-stretch 1.0 --output-dir out --suffix _cents</code>	Applies precise microtonal offset without tempo change.

Transform selection

Workflow	Command	Why
Default production backend (FFT + transient protection)	<code>python3 pvxvoc.py mix.wav --transform fft --time-stretch 1.07 --transient-preserve --phase-locking identity --output-dir out --suffix _fft</code>	Use when you need the fastest and most stable general-purpose phase-vocoder path.
Reference Fourier baseline using explicit DFT mode	<code>python3 pvxvoc.py tone_sweep.wav --transform dft --time-stretch 1.00 --pitch-shift-semitones 0 --output-dir out --suffix _dft_ref</code>	Useful for parity checks and controlled transform-comparison experiments.
Prime-size frame experiment with CZT backend	<code>python3 pvxvoc.py archival_take.wav --transform czt --n-fft 1531 --win-length 1531 --hop-size 382 --time-stretch 1.03 --output-dir out --suffix _czt</code>	Alternative numerical path for awkward/prime frame sizes when validating edge cases.
DCT timbral compaction for smooth harmonic material	<code>python3 pvxvoc.py strings.wav --transform dct --pitch-shift-cents -18 --soft-clip-level 0.95 --output-dir out --suffix _dct</code>	Real-basis coefficients can emphasize envelope-like structure for creative reshaping.
DST odd-symmetry color pass	<code>python3 pvxvoc.py snare_loop.wav --transform dst --time-stretch 0.92 --phase-locking off --output-dir out --suffix _dst</code>	Provides an alternate real-basis artifact profile useful for creative percussive processing.
Hartley real-basis exploratory render	<code>python3 pvxvoc.py synth_pad.wav --transform hartley --time-stretch 1.30 --pitch-shift-semitones 3 --output-dir out --suffix _hartley</code>	Compares Hartley-domain behavior against complex FFT phase-vocoder output.
A/B sweep of transform backends from shell loop	<code>for t in fft dft czt dct dst hartley; do python3 pvxvoc.py voice.wav --transform "\$t" --time-stretch 1.1 --output-dir out --suffix "_\$t"; done</code>	Fast listening workflow for selecting the least-artifact transform on your source.

Microtonal

Workflow	Command	Why
Custom cents map retune	<code>python3 pvxretune.py vox.wav --root 60 --scale-cents 0,90,204,294,408,498,612,702,816,906,1020,1110 --strength 0.8 --output-dir out</code>	Maps incoming notes to a custom 12-degree microtonal scale.
Conform CSV with per-segment ratios	<code>python3 pvxconform.py solo.wav map_conform.csv --pitch-mode ratio --output-dir out --suffix _conform</code>	Applies timeline-specific time and pitch trajectories from CSV.

Pipelines

Workflow	Command	Why
Time-stretch -> denoise -> dereverb in one pipe	<code>python3 pvxvoc.py input.wav --time-stretch 1.25 --stdout python3 pvxdenoise.py - --reduction-db 10 --stdout python3 pvxdeverb.py - --strength 0.45 --output-dir out --suffix _clean</code>	Single-pass CLI chain for serial DSP in Unix pipes.
Morph -> formant -> unison	<code>python3 pvxmorph.py a.wav b.wav -o - python3 pvxformant.py - --mode preserve --stdout python3 pvxunison.py - --voices 5 --detune-cents 8 --output-dir out --suffix _morph_stack</code>	Builds a richer timbre chain with no intermediate files.

Mastering

Workflow	Command	Why
Integrated loudness targeting with limiter	<code>python3 pvxvoc.py mix.wav --time-stretch 1.0 --target-lufs -14 --compressor-threshold-db -20 --compressor-ratio 3 --limiter-threshold 0.98 --output-dir out --suffix _master</code>	Combines dynamics and loudness controls in shared mastering chain.
Soft clip and hard safety ceiling	<code>python3 pvxharmonize.py bus.wav --intervals 0,7,12 --mix 0.35 --soft-clip-level 0.92 --soft-clip-type tanh --hard-clip-level 0.99 --output-dir out</code>	Adds saturation while enforcing a strict final peak ceiling.

Batch

Workflow	Command	Why
Batch stretch over folder	<code>python3 pvxvoc.py stems/*.wav --time-stretch 1.08 --output-dir out/stems --overwrite</code>	Applies consistent transform to many files with one command.
Dry-run output validation	<code>python3 pvxdenoise.py takes/*.wav --reduction-db 8 --dry-run --output-dir out/preview</code>	Checks filename resolution and collisions without writing audio.

Spatial

Workflow	Command	Why
VBAP adaptive panning via algorithm dispatcher	<code>python3 -m pvx.algorithms.spatial_and_multichannel.imaging_and_panning.vbap_adaptive_panning input.wav --output-channels 6 --azimuth-deg 35 --width 0.8 --output out/vbap.wav</code>	Demonstrates algorithm-level spatial module invocation.

Analysis/QA

Workflow	Command	Why
Quality metrics on processed speech	<pre>python3 -m pvx.algorithms.analysis_qa_and_automation.pesq_stoi_visq ol_quality_metrics clean.wav noisy.wav --output out/qa.json</pre>	Collects objective quality indicators for regression tracking.

pvx CLI Flag Index

Source: [cli_flags.html](#)

Total unique long flags: **112**

Source index: [docs/CLI_FLAGS_REFERENCE.md](#) and [docs/cli_flags_reference.json](#).

main.py

Flag	Required	Default	Choices	Action	Description	Source
<code>--list-algorithm-package</code>	False	<input type="checkbox"/>	<input type="checkbox"/>	<code>store_true</code>	Print location of pvxalgorithms package and registry files	src/pvx/cli/main.py
<code>--list-tools</code>	False	<input type="checkbox"/>	<input type="checkbox"/>	<code>store_true</code>	Print the primary ppx CLI tools	src/pvx/cli/main.py
<code>--show-docs</code>	False	<input type="checkbox"/>	<input type="checkbox"/>	<code>store_true</code>	Print key generated documentation paths	src/pvx/cli/main.py

pvxconform.py

Flag	Required	Default	Choices	Action	Description	Source
<code>--crossfade-ms</code>	False	<code>8.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Segment crossfade in milliseconds	src/pvx/cli/pvxconform.py
<code>--map</code>	True	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	CSV map path	src/pvx/cli/pvxconform.py
<code>--resample-mode</code>	False	<code>auto</code>	<code>auto, fft, linear</code>	<input type="checkbox"/>		src/pvx/cli/pvxconform.py

pvxdenoise.py

Flag	Required	Default	Choices	Action	Description	Source
<code>--floor</code>	False	<code>0.1</code>	<input type="checkbox"/>	<input type="checkbox"/>	Noise floor multiplier	src/pvx/cli/pvxdenoise.py
<code>--noise-file</code>	False	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Optional external noise reference	src/pvx/cli/pvxdenoise.py
<code>--noise-seconds</code>	False	<code>0.35</code>	<input type="checkbox"/>	<input type="checkbox"/>	Noise profile duration from start	src/pvx/cli/pvxdenoise.py
<code>--reduction-db</code>	False	<code>12.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Reduction strength in dB	src/pvx/cli/pvxdenoise.py
<code>--smooth</code>	False	<code>5</code>	<input type="checkbox"/>	<input type="checkbox"/>	Temporal smoothing frames	src/pvx/cli/pvxdenoise.py

pvxdeverb.py

Flag	Required	Default	Choices	Action	Description	Source
--decay	False	0.92			Tail memory decay 0..1	src/pvx/cli/pvxdeverb.py
--floor	False	0.12			Per-bin floor multiplier	src/pvx/cli/pvxdeverb.py
--strength	False	0.45			Tail suppression strength 0..1	src/pvx/cli/pvxdeverb.py

pvxformant.py

Flag	Required	Default	Choices	Action	Description	Source
--formant-lifter	False	32				src/pvx/cli/pvxformant.py
--formant-max-gain-db	False	12.0				src/pvx/cli/pvxformant.py
--formant-shift-ratio	False	1.0			Formant ratio (>1 up, <1 down)	src/pvx/cli/pvxformant.py
--mode	False	shift, preserve				src/pvx/cli/pvxformant.py
--pitch-shift-cents	False	0.0			Additional microtonal pitch shift in cents before formant stage	src/pvx/cli/pvxformant.py
--pitch-shift-semitones	False	0.0			Optional pitch shift before formant stage	src/pvx/cli/pvxformant.py
--resample-mode	False	auto	auto, fft, linear			src/pvx/cli/pvxformant.py

pvxfreeze.py

Flag	Required	Default	Choices	Action	Description	Source
--duration	False	3.0			Output freeze duration in seconds	src/pvx/cli/pvxfreeze.py
--freeze-time	False	0.2			Freeze anchor time in seconds	src/pvx/cli/pvxfreeze.py
--random-phase	False			store_true	Add subtle phase randomization per frame	src/pvx/cli/pvxfreeze.py

pvxharmonize.py

Flag	Required	Default	Choices	Action	Description	Source
--force-stereo	False			store_true	Mix result as stereo with panning	src/pvx/cli/pvxharmonize.py
--gains	False				Optional comma-separated linear gain per voice	src/pvx/cli/pvxharmonize.py
--interval	False	0, 4, 7			Comma-separated semitone intervals per voice (supports fractional values)	src/pvx/cli/pvxharmonize.py

Flag	Required	Default	Choices	Action	Description	Source
--intervals -cents	False				Optional cents offsets per voice, added to --intervals (e.g. 0,14,-12)	src/pvx/cli/pvxharmonize.py
--pans	False				Optional comma-separated pan per voice [-1..1]	src/pvx/cli/pvxharmonize.py
--resample-mode	False	auto	auto, fft, linear			src/pvx/cli/pvxharmonize.py

pvxlayer.py

Flag	Required	Default	Choices	Action	Description	Source
--harmonic-gain	False	1.0				src/pvx/cli/pvxlayer.py
--harmonic-kernel	False	31				src/pvx/cli/pvxlayer.py
--harmonic-pitch-cents	False	0.0				src/pvx/cli/pvxlayer.py
--harmonic-pitch-semitones	False	0.0				src/pvx/cli/pvxlayer.py
--harmonic-stretch	False	1.0				src/pvx/cli/pvxlayer.py
--percussive-gain	False	1.0				src/pvx/cli/pvxlayer.py
--percussive-kernel	False	31				src/pvx/cli/pvxlayer.py
--percussive-pitch-cents	False	0.0				src/pvx/cli/pvxlayer.py
--percussive-pitch-semitones	False	0.0				src/pvx/cli/pvxlayer.py
--percussive-stretch	False	1.0				src/pvx/cli/pvxlayer.py
--resample-mode	False	auto	auto, fft, linear			src/pvx/cli/pvxlayer.py

pvxmorph.py

Flag	Required	Default	Choices	Action	Description	Source
--alpha	False	0.5			Morph amount 0..1 (0=A, 1=B)	src/pvx/cli/pvxmorph.py
--output	False				Output file path	src/pvx/cli/pvxmorph.py

Flag	Required	Default	Choices	Action	Description	Source
--output-format	False				Output extension/format; for --stdout defaults to wav	src/pvx/cli/pvxmorph.py
--overwrite	False			store_true		src/pvx/cli/pvxmorph.py
--stdout	False			store_true	Write processed audio to stdout stream (for piping); equivalent to -o -	src/pvx/cli/pvxmorph.py
--subtype	False					src/pvx/cli/pvxmorph.py

pvxretune.py

Flag	Required	Default	Choices	Action	Description	Source
--chunk-ms	False	80.0			Analysis/process chunk duration in ms	src/pvx/cli/pvxretune.py
--f0-max	False	1200.0				src/pvx/cli/pvxretune.py
--f0-min	False	60.0				src/pvx/cli/pvxretune.py
--overlap-ms	False	20.0			Chunk overlap in ms	src/pvx/cli/pvxretune.py
--resample-mode	False	auto	auto, fft, linear			src/pvx/cli/pvxretune.py
--root	False	C			Scale root note (C,C#,D,...,B)	src/pvx/cli/pvxretune.py
--scale	False	chromatic			Named scale for 12-TET quantization	src/pvx/cli/pvxretune.py
--scale-cents	False				Optional comma-separated microtonal scale degrees in cents within one octave, relative to --root (example: 0,90,204,294,408,498,612,702,816,906,1020,1110)	src/pvx/cli/pvxretune.py

Flag	Required	Default	Choices	Action	Description	Source
--strength	False	0.85			Correction strength 0..1	src/pvx/cli/pvxreturn.py

pvxtransient.py

Flag	Required	Default	Choices	Action	Description	Source
--pitch-shift-cents	False				Optional microtonal pitch shift in cents (added to --pitch-shift-semitones)	src/pvx/cli/pvxtransient.py
--pitch-shift-ratio	False				Pitch ratio override. Accepts decimals (1.5), integer ratios (3/2), and expressions ($2^{(1/12)}$).	src/pvx/cli/pvxtransient.py
--pitch-shift-semitones	False	0.0				src/pvx/cli/pvxtransient.py
--resample-mode	False	auto	auto, fft, linear			src/pvx/cli/pvxtransient.py
--target-duration	False				Target duration in seconds	src/pvx/cli/pvxtransient.py
--time-stretch	False	1.0				src/pvx/cli/pvxtransient.py
--transient-threshold	False	1.6				src/pvx/cli/pvxtransient.py

pvxunison.py

Flag	Required	Default	Choices	Action	Description	Source
--detune-cents	False	14.0			Total detune span in cents	src/pvx/cli/pvxunison.py
--dry-mix	False	0.2			Dry signal mix amount	src/pvx/cli/pvxunison.py
--resample-mode	False	auto	auto, fft, linear			src/pvx/cli/pvxunison.py
--voices	False	5			Number of unison voices	src/pvx/cli/pvxunison.py
--width	False	1.0			Stereo width multiplier 0..2	src/pvx/cli/pvxunison.py

pvxvoc.py

Flag	Required	Default	Choices	Action	Description	Source
<code>--analysis-channel</code>	False	<code>mix</code>	<code>first, mix</code>	<input type="checkbox"/>	Channel strategy for F0 estimation with --target-f0 (default: mix)	<code>src/pvx/core/voc.py</code>
<code>--clip</code>	False	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <code>store_true</code>	Legacy alias: hard clip at +/-1.0 when set	<code>src/pvx/core/voc.py</code>
<code>--compander-attack-ms</code>	False	<code>8.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compander attack time in ms	<code>src/pvx/core/voc.py</code>
<code>--compander-compress-ratio</code>	False	<code>3.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compander compression ratio (>=1)	<code>src/pvx/core/voc.py</code>
<code>--compander-expand-ratio</code>	False	<code>1.8</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compander expansion ratio (>=1)	<code>src/pvx/core/voc.py</code>
<code>--compander-makeup-db</code>	False	<code>0.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compander makeup gain in dB	<code>src/pvx/core/voc.py</code>
<code>--compander-release-ms</code>	False	<code>120.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compander release time in ms	<code>src/pvx/core/voc.py</code>
<code>--compander-threshold-db</code>	False	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enable compander threshold in dBFS	<code>src/pvx/core/voc.py</code>
<code>--compressor-attack-ms</code>	False	<code>10.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compressor attack time in ms	<code>src/pvx/core/voc.py</code>
<code>--compressor-makeup-db</code>	False	<code>0.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compressor makeup gain in dB	<code>src/pvx/core/voc.py</code>
<code>--compressor-ratio</code>	False	<code>4.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compressor ratio (>=1)	<code>src/pvx/core/voc.py</code>
<code>--compressor-release-ms</code>	False	<code>120.0</code>	<input type="checkbox"/>	<input type="checkbox"/>	Compressor release time in ms	<code>src/pvx/core/voc.py</code>
<code>--compressor-threshold-db</code>	False	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enable compressor above threshold dBFS	<code>src/pvx/core/voc.py</code>

Flag	Required	Default	Choices	Action	Description	Source
--cuda-device	False	0			CUDA device index used when --device is auto/cuda (default: 0)	src/pvx/core/voc.py
--device	False	auto	auto, cpu, cuda		Compute device: auto (prefer CUDA), cpu, or cuda	src/pvx/core/voc.py
--dry-run	False			store_true	Resolve settings without writing files	src/pvx/core/voc.py
--expander-attack-ms	False	5.0			Expander attack time in ms	src/pvx/core/voc.py
--expander-ratio	False	2.0			Expander ratio (>=1)	src/pvx/core/voc.py
--expander-release-ms	False	120.0			Expander release time in ms	src/pvx/core/voc.py
--expander-threshold-db	False				Enable downward expander below threshold dBFS	src/pvx/core/voc.py
--f0-max	False	1000.0			Maximum F0 search bound in Hz (default: 1000)	src/pvx/core/voc.py
--f0-min	False	50.0			Minimum F0 search bound in Hz (default: 50)	src/pvx/core/voc.py
--formant-lifter	False	32			Cepstral lifter cutoff for formant envelope extraction (default: 32)	src/pvx/core/voc.py
--formant-max-gain-db	False	12.0			Max per-bin formant correction gain in dB (default: 12)	src/pvx/core/voc.py
--formant-strength	False	1.0			Formant correction blend 0..1 when pitch mode is formant-preserving (default: 1.0)	src/pvx/core/voc.py
--fourier-sync	False			store_true	Enable fundamental frame locking. Uses generic short-time Fourier transforms with per-frame FFT sizes locked to detected F0.	src/pvx/core/voc.py
--fourier-sync-max-fft	False	8192			Maximum frame FFT size for --fourier-sync (default: 8192)	src/pvx/core/voc.py

Flag	Required	Default	Choices	Action	Description	Source
--fourier-sync-min-fft	False	256			Minimum frame FFT size for --fourier-sync (default: 256)	src/pvx/core/voc.py
--fourier-sync-smooth	False	5			Smoothing span (frames) for prescanned F0 track in --fourier-sync (default: 5)	src/pvx/core/voc.py
--hard-clip-level	False				Hard clip level in linear full-scale	src/pvx/core/voc.py
--hop-size	False	512			Hop size in samples (default: 512)	src/pvx/core/voc.py
--kaiser-beta	False	14.0			Kaiser window beta parameter used when --window kaiser (default: 14.0)	src/pvx/core/voc.py
--limiter-threshold	False				Peak limiter threshold in linear full-scale	src/pvx/core/voc.py
--n-fft	False	2048			FFT size (default: 2048)	src/pvx/core/voc.py
--no-center	False			store_true	Disable center padding in STFT/ISTFT	src/pvx/core/voc.py
--no-progress	False			store_true		src/pvx/core/voc.py
--normalize	False	none	none, peak, rms		Output normalization mode	src/pvx/core/voc.py
--output-dir	False				Directory for output files (default: same directory as each input)	src/pvx/core/voc.py
--output-format	False				Output format/extension (e.g. wav, flac, aiff). Default: keep input extension.	src/pvx/core/voc.py
--overwrite	False			store_true	Overwrite existing outputs	src/pvx/core/voc.py
--peak-dbfs	False				Target peak dBFS when --normalize peak	src/pvx/core/voc.py
--phase-locking	False	identity	off, identity		Inter-bin phase locking mode for transient fidelity (default: identity)	src/pvx/core/voc.py

Flag	Required	Default	Choices	Action	Description	Source
--pitch-mode	False	standard	standard, formant-preserving		Pitch mode: standard shift or formant-preserving correction (default: standard)	src/pvx/core/voc.py
--pitch-shift-cents	False				Pitch shift in cents (+1200 is one octave up)	src/pvx/core/voc.py
--pitch-shift-ratio	False				Pitch ratio (>1 up, <1 down). Accepts decimals (1.5), integer ratios (3/2), and expressions ($2^{(1/12)}$).	src/pvx/core/voc.py
--pitch-shift-semitones	False				Pitch shift in semitones (+12 is one octave up)	src/pvx/core/voc.py
--quiet	False			store_true	Reduce output and hide status bars	src/pvx/core/voc.py
--resample-mode	False	auto	auto, fft, linear		Resampling engine (auto=fft if scipy available, else linear)	src/pvx/core/voc.py
--rms-dBFS	False				Target RMS dBFS when --normalize rms	src/pvx/core/voc.py
--silent	False			store_true	Suppress all console output	src/pvx/core/voc.py
--soft-clip-drive	False	1.0			Soft clip drive amount (>0)	src/pvx/core/voc.py
--soft-clip-level	False				Soft clip output ceiling in linear full-scale	src/pvx/core/voc.py
--soft-clip-type	False	tanh	tanh, arctan, cubic		Soft clip transfer type	src/pvx/core/voc.py
--stdout	False			store_true	Write processed audio to stdout stream (for piping); requires exactly one input	src/pvx/core/voc.py
--subtype	False				Output file subtype for soundfile (e.g. PCM_16, PCM_24, FLOAT)	src/pvx/core/voc.py
--suffix	False	_pv			Suffix appended to output filename stem (default: _pv)	src/pvx/core/voc.py
--target-duration	False				Absolute target duration in seconds (overrides --time-stretch)	src/pvx/core/voc.py

Flag	Required	Default	Choices	Action	Description	Source
--target-f0	False				Target fundamental frequency in Hz. Auto-estimates source F0 per file.	src/pvx/core/voc.py
--target-lufs	False				Integrated loudness target in LUFS	src/pvx/core/voc.py
--target-pitch-shift-semitones	False				Pitch shift in semitones (+12 is one octave up)	src/pvx/core/voc.py
--target-sample-rate	False				Output sample rate in Hz (default: keep input rate)	src/pvx/core/voc.py
--time-stretch	False	1.0			Final duration multiplier (1.0=unchanged, 2.0=2x longer)	src/pvx/core/voc.py
--transform	False	fft			Per-frame transform backend for STFT/ISTFT paths (default: fft; options: fft, dft, czt, dct, dst, hartley)	src/pvx/core/voc.py
--transient-preserve	False			store_true	Enable transient phase resets based on spectral flux	src/pvx/core/voc.py
--transient-threshold	False	2.0			Spectral-flux multiplier for transient detection (default: 2.0)	src/pvx/core/voc.py
--verbose	False	0		count	Increase verbosity (repeat for extra detail)	src/pvx/core/voc.py
--verbosity	False	normal			Console verbosity level	src/pvx/core/voc.py
--win-length	False	2048			Window length in samples (default: 2048)	src/pvx/core/voc.py
--window	False	hann			Window type (default: hann)	src/pvx/core/voc.py

pvxwarp.py

Flag	Required	Default	Choices	Action	Description	Source
--crossfade-ms	False	8.0				src/pvx/cli/pvxwarp.py
--map	True				CSV map with start_sec,end_sec/stretch	src/pvx/cli/pvxwarp.py

Flag	Required	Default	Choices	Action	Description	Source
--resample-mode	False	auto	auto, fft, linear			src/pvx/cli/pvx_warp.py

pvx Citation Quality

Source: citations.html

Citation quality report and BibTeX export.

[docs/references.bib](#)

Link-Type Summary

Link type	Count
arxiv	7
doi	34
publisher_or_standard	8
scholar	110
web	6

Scholar-Link Entries (upgrade candidates)

Year	Authors	Title	URL
1976	M. R. Portnoff	Implementation of the Digital Phase Vocoder Using the Fast Fourier Transform	link
1980	M. R. Portnoff	Time-Scale Modification of Speech Based on Short-Time Fourier Analysis	link
1986	R. J. McAulay; T. F. Quatieri	Speech Analysis/Synthesis Based on a Sinusoidal Representation	link
2002	C. Duxbury; M. Davies; M. Sandler	Improved Time-Scaling of Musical Audio Using Phase Locking at Transients	link
2000	J. Bonada	Automatic Technique in Frequency Domain for Near-Lossless Time-Scale Modification of Audio	link
1985	N. Roucos; A. Wilgus	High Quality Time-Scale Modification for Speech	link
1993	W. Verhelst; M. Roelands	An Overlap-Add Technique Based on Waveform Similarity (WSOLA) for High Quality Time-Scale Modification of Speech	link
2002	S. Arfib; D. Keiler; U. Zölzer	DAFX: Digital Audio Effects (chapter references on pitch/time processing)	link
1967	A. M. Noll	Cepstrum Pitch Determination	link
1976	L. R. Rabiner; M. J. Cheng; A. E. Rosenberg; C. A. McGonegal	A Comparative Performance Study of Several Pitch Detection Algorithms	link
1995	D. Talkin	A Robust Algorithm for Pitch Tracking (RAPT)	link
1993	P. Boersma	Accurate Short-Term Analysis of the Fundamental Frequency and the Harmonics-to-Noise Ratio of a Sampled Sound	link
2010	C. Schörkhuber; A. Klapuri	Constant-Q Transform Toolbox for Music Processing	link
2002	P. Flandrin; F. Auger; E. Chassande-Mottin	Time-Frequency Reassignment: From Principles to Algorithms	link

Year	Authors	Title	URL
1991	S. Mann; S. Haykin	The Chirplet Transform: Physical Considerations	link
2007	T. Virtanen	Monaural Sound Source Separation by Nonnegative Matrix Factorization with Temporal Continuity and Sparseness Criteria	link
1949	N. Wiener	Extrapolation, Interpolation, and Smoothing of Stationary Time Series	link
1996	P. Scalart; J. V. Filho	Speech Enhancement Based on a Priori Signal to Noise Estimation	link
2012	Y. Yoshioka; T. Nakatani	Generalization of Multi-Channel Linear Prediction Methods for Blind MIMO Impulse Response Shortening	link
1997	S. Pulkki	Virtual Sound Source Positioning Using Vector Base Amplitude Panning	link
2019	M. H. C. de Gesmundo et al.	ViSQOL v3: An Open Source Production Ready Objective Speech and Audio Metric	link
1989	R. Bristow-Johnson; M. Bogdanowicz	Phase Vocoder Done Right	link
1998	S. Disch	A New Phase Vocoder Technique for Time-Scale Modification of Audio Signals	link
1995	M. Puckette	Phase-Locked Vocoder	link
2012	B. Zavalishin	The Art of VA Filter Design (sections on phase and spectral processing)	link
2009	N. Moreau	Toolbox for Time-Scale Modification and Pitch-Shifting of Audio Signals	link
2013	M. Dolson	History of the Phase Vocoder	link
2010	D. S. Hamon; A. Lazarides	Improved WSOLA for Real-Time Time-Scale Modification	link
2015	M. Riess; A. R. Chhetri	Transient Preservation in Time-Scale Modification	link
2008	J. Bonada	Wide-Band Harmonic Sinusoidal Modeling for Time-Scale and Pitch-Scale Modification	link
2004	A. de Cheveigne	Pitch and Time Manipulation of Speech	link
2011	M. Le Roux; E. Vincent	Consistent Wiener Filtering for Audio Source Separation and Time-Frequency Processing	link
2003	J. Laroche	About this Phasiness Business	link
2014	J. Driedger; T. Pratzlich; M. Muller	Let It Bee - Towards NMF-Inspired Audio Mosaicing	link
2010	A. Roebel	A Shape-Invariant Phase Vocoder for Speech Transformation	link
2001	H. Kawahara; A. de Cheveigne	STRAIGHT, Exploitation of the Other Aspects of Vocal Source Information	link
2006	A. Klapuri	Multiple Fundamental Frequency Estimation by Harmonicity and Spectral Smoothness	link
2005	M. McLeod; G. Wyvill	A Smarter Way to Find Pitch	link
1999	S. Ahmadi; H. Spanias	Cepstrum-Based Pitch Detection Using FFT	link
2018	S. Bock; M. Korzeniowski	piano_transcription - F0 and onset tracking	link
2015	B. W. Schuller et al.	Paralinguistics and robust pitch tracking methods	link
2012	K. Dressler	Sinusoidal Extraction using Frequency-Domain Matching Pursuit	link
2000	S. Kum; C. L. Nikias	Robust F0 Estimation in Noise	link
2001	K. Grochenig	Foundations of Time-Frequency Analysis	link

Year	Authors	Title	URL
1998	P. Flandrin	Time-Frequency/Time-Scale Analysis	link
1995	D. L. Donoho	De-Noising by Soft-Thresholding	link
1993	S. Mallat; Z. Zhang	Matching Pursuits with Time-Frequency Dictionaries	link
1989	L. Cohen	Time-Frequency Distributions - A Review	link
2010	A. V. Oppenheim; R. W. Schafer	Discrete-Time Signal Processing (STFT and filter-bank chapters)	link
2006	A. C. Gilbert; M. J. Strauss	Approximation of signals in sparse Fourier dictionaries	link
2019	M. Doring; M. M. Kokuer	Practical NSGT audio applications	link
2012	S. Essid; G. Richard	Musical signal analysis with reassignment methods	link
2007	P. Smaragdis	Convulsive Speech Bases and Their Application to Supervised Speech Separation	link
2009	C. Fevotte; N. Bertin; J.-L. Durrieu	Nonnegative Matrix Factorization with the Itakura-Saito Divergence	link
2000	A. Hyvarinen; E. Oja	Independent Component Analysis: Algorithms and Applications	link
2011	E. J. Candes; X. Li; Y. Ma; J. Wright	Robust Principal Component Analysis?	link
2011	N. Ono	Stable and fast update rules for independent low-rank matrix analysis based on auxiliary function technique	link
1995	A. J. Bell; T. J. Sejnowski	An Information-Maximization Approach to Blind Separation and Blind Deconvolution	link
2019	J. Le Roux; S. Wisdom; H. Erdogan; J. R. Hershey	SDR half-baked or well done?	link
2019	A. Defossez et al.	Music Source Separation in the Waveform Domain	link
2018	N. Takahashi et al.	MMDDenseLSTM for source separation	link
2019	F.-R. Stoter; S. Uhlich; A. Liutkus; Y. Mitsufuji	Open-Unmix	link
2001	I. Cohen; B. Berdugo	Speech Enhancement for Non-Stationary Noise Environments	link
1979	S. Boll	Suppression of Acoustic Noise in Speech Using Spectral Subtraction	link
2012	T. Yoshioka; T. Nakatani	Generalization of Multi-Channel Linear Prediction Methods for Blind MIMO Impulse Response Shortening	link
2012	N. D. Gaubitch; P. A. Naylor	Speech Dereverberation	link
2016	K. Kinoshita et al.	A summary of the REVERB challenge	link
2018	N. W. D. Evans et al.	The voicehome and CHiME challenges	link
2018	J.-M. Valin	A Hybrid DSP/Deep Learning Approach to Real-Time Full-Band Speech Enhancement	link
2019	A. Pandey; D. Wang	A New Framework for CNN-Based Speech Enhancement in the Time Domain	link
2001	A. Rix et al.	Perceptual Evaluation of Speech Quality (PESQ)	link
2011	C. Taal et al.	An Algorithm for Intelligibility Prediction of Time-Frequency Weighted Noisy Speech	link
2012	A. Hines et al.	VISQOL: An Objective Speech Quality Model	link

Year	Authors	Title	URL
2011	K. K. Paliwal	Importance of phase in speech enhancement	link
2013	P. C. Loizou	Speech Enhancement: Theory and Practice	link
2015	S. Doclo et al.	Acoustic beamforming for hearing aid applications	link
1973	M. A. Gerzon	Periphony: With-Height Sound Reproduction	link
1985	M. A. Gerzon	Ambisonics in Multichannel Broadcasting and Video	link
1997	V. Pulkki	Virtual Sound Source Positioning Using Vector Base Amplitude Panning	link
2005	M. Poletti	Three-Dimensional Surround Sound Systems Based on Spherical Harmonics	link
2015	B. Rafaely	Fundamentals of Spherical Array Processing	link
1997	J. Blauert	Spatial Hearing	link
1999	W. M. Hartmann	How We Localize Sound	link
2008	J. Benesty; J. Chen; Y. Huang	Microphone Array Signal Processing	link
2002	H. L. Van Trees	Optimum Array Processing	link
1982	L. Griffiths; C. Jim	An Alternative Approach to Linearly Constrained Adaptive Beamforming	link
2001	M. Brandstein; D. Ward	Microphone Arrays: Signal Processing Techniques and Applications	link
1997	M. S. Brandstein	A Pitch-Based Real-Time Tracking of Speech Source	link
2019	F. Zotter; M. Frank	Ambisonics: A Practical 3D Audio Theory	link
2001	J. Daniel	Spatial Sound Encoding Including Near Field Effect	link
2006	E. A. P. Habets	Room Impulse Response Generator	link
2006	S. Spors; R. Rabenstein	Spatial Sound Reproduction by Wave Field Synthesis	link
2018	A. Politis et al.	A Dataset of Binaural Room Impulse Responses for Evaluation of Spatial Audio Algorithms	link
2000	A. Farina	Simultaneous Measurement of Impulse Response and Distortion with a Swept-Sine Technique	link
2001	P. Minnaar et al.	A Localization Model for Binaural Rendering	link
2005	M. A. Poletti	A Unified Theory of Horizontal Holographic and Ambisonic Sound Systems	link
2007	T. Lund	Loudness and True-Peak in Digital Audio	link
2020	S. Stables et al.	A Study of Loudness Normalization in Streaming Services	link
2018	M. Fenton	Practical Dynamics Processing for Modern Music Production	link
2011	J. Reiss	Under the Hood of a Dynamic Range Compressor	link
2012	D. Giannoulis; M. Massberg; J. Reiss	Digital Dynamic Range Compressor Design	link
2015	M. Ballou	Handbook for Sound Engineers (Loudness and Dynamics chapters)	link
2017	A. Gibiansky et al.	Deep Voice 2: Multi-Speaker Neural Text-to-Speech	link
2018	N. Kalchbrenner et al.	Efficient Neural Audio Synthesis	link
2019	R. Prenger et al.	WaveGlow: A Flow-based Generative Network for Speech Synthesis	link

Year	Authors	Title	URL
2019	K. Kumar et al.	MeIGAN: Generative Adversarial Networks for Conditional Waveform Synthesis	link
2020	J. Kong et al.	HiFi-GAN: Generative Adversarial Networks for Efficient and High Fidelity Speech Synthesis	link
2017	Y. Wang et al.	Tacotron: Towards End-to-End Speech Synthesis	link
2021	S. Wisdom et al.	Differentiable Consistency Constraints for Improved Deep Speech Enhancement	link
2018	C. Donahue; J. McAuley; M. Puckette	Adversarial Audio Synthesis	link

pvx Group: Analysis, QA, and Automation

Source: groups/analysis_qa_and_automation.html

Theme: Analysis, QA, and Automation

Folder: analysis_qa_and_automation | **Algorithms:** 8

Subgroups: core (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>analysis_qa_and_automation.onset_beat_downbeat_tracking</code>	Onset/beat/downbeat tracking	core	<code>src/pvx/algorithms/analysis_qa_and_automation/onset_beat_downbeat_tracking.py</code>	None (generic/default path)	None
<code>analysis_qa_and_automation.key_chord_detection</code>	Key/chord detection	core	<code>src/pvx/algorithms/analysis_qa_and_automation/key_chord_detection.py</code>	None (generic/default path)	None
<code>analysis_qa_and_automation.structure_segmentation_verse_chorus_sections</code>	Structure segmentation (verse/chorus/sections)	core	<code>src/pvx/algorithms/analysis_qa_and_automation/structure_segmentation_verse_chorus_sections.py</code>	None (generic/default path)	Structure segmentation
<code>analysis_qa_and_automation.silence_speech_music_classifiers</code>	Silence/speech/music classifiers	core	<code>src/pvx/algorithms/analysis_qa_and_automation/silence_speech_music_classifiers.py</code>	None (generic/default path)	None
<code>analysis_qa_and_automation.clip_hum_buzz_artifact_detection</code>	Clip/hum/buzz artifact detection	core	<code>src/pvx/algorithms/analysis_qa_and_automation/clip_hum_buzz_artifact_detection.py</code>	None (generic/default path)	None
<code>analysis_qa_and_automation.pesq_stoi_visqol_quality_metrics</code>	PESQ/STOI/VISQOL quality metrics	core	<code>src/pvx/algorithms/analysis_qa_and_automation/pesq_stoi_visqol_quality_metrics.py</code>	None (generic/default path)	PESQ, STOI, VisQOL
<code>analysis_qa_and_automation.auto_parameter_tuning_bayesian_optimization</code>	Auto-parameter tuning (Bayesian optimization)	core	<code>src/pvx/algorithms/analysis_qa_and_automation/auto_parameter_tuning_bayesian_optimization.py</code>	<code>target_center</code>	Bayesian optimization

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
analysis_qa_and_automation.batch_preset_recommendation_based_on_source_features	Batch preset recommendation based on source features	core	src/pvx/algorithms/analysis_qa_and_automation/batch_preset_recommendation_based_on_source_features.py	None (generic/default path)	None

pvx Group: Creative Spectral Effects

Source: groups/creative_spectral_effects.html

Theme: Creative Spectral Effects

Folder: creative_spectral_effects | **Algorithms:** 8

Subgroups: core (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>creative_spectral_effects.cross_synthesis_vocoder</code>	Cross-synthesis vocoder	core	<code>src/pvx/algorithms/creative_spectral_effects/cross_synthesis_vocoder.py</code>	None (generic/default path)	Cross synthesis
<code>creative_spectral_effects.spectral_convolution_effects</code>	Spectral convolution effects	core	<code>src/pvx/algorithms/creative_spectral_effects/spectral_convolution_effects.py</code>	<code>kernel_size</code>	Convolution
<code>creative_spectral_effects.spectral_freeze_banks</code>	Spectral freeze banks	core	<code>src/pvx/algorithms/creative_spectral_effects/spectral_freeze_banks.py</code>	<code>frame_ratio</code>	None
<code>creative_spectral_effects.spectral_blur_smear</code>	Spectral blur/smear	core	<code>src/pvx/algorithms/creative_spectral_effects/spectral_blur_smear.py</code>	None (generic/default path)	None
<code>creative_spectral_effects.phase_randomization_textures</code>	Phase randomization textures	core	<code>src/pvx/algorithms/creative_spectral_effects/phase_randomization_textures.py</code>	<code>strength</code>	None
<code>creative_spectral_effects.formant_painting_warping</code>	Formant painting/warping	core	<code>src/pvx/algorithms/creative_spectral_effects/formant_painting_warping.py</code>	<code>ratio</code>	Formant
<code>creative_spectral_effects.resonator_filterbank_morphing</code>	Resonator/filterbank morphing	core	<code>src/pvx/algorithms/creative_spectral_effects/resonator_filterbank_morphing.py</code>	None (generic/default path)	Resonator
<code>creative_spectral_effects.spectral_contrast_exaggeration</code>	Spectral contrast exaggeration	core	<code>src/pvx/algorithms/creative_spectral_effects/spectral_contrast_exaggeration.py</code>	<code>amount</code>	None

pvx Group: Denoise and Restoration

Source: groups/denoise_and_restoration.html

Theme: Denoise and Restoration

Folder: `denoise_and_restoration` | **Algorithms:** 8

Subgroups: `core` (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>denoise_and_restoration.wiener_denoising</code>	Wiener denoising	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/wiener_denoising.py</code>	None (generic/default path)	None
<code>denoise_and_restoration.mmse_stsa</code>	MMSE-STSA	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/mmse_stsa.py</code>	None (generic/default path)	MMSE-STSA
<code>denoise_and_restoration.log_mmse</code>	Log-MMSE	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/log_mmse.py</code>	None (generic/default path)	Log-MMSE
<code>denoise_and_restoration.minimum_statistics_noise_tracking</code>	Minimum-statistics noise tracking	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/minimum_statistics_noise_tracking.py</code>	None (generic/default path)	Minimum statistics
<code>denoise_and_restoration.rnnoise_style_denoiser</code>	RNNoise-style denoiser	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/rnnoise_style_denoiser.py</code>	None (generic/default path)	RNNoise
<code>denoise_and_restoration.diffusion_based_speech_audio_denoise</code>	Diffusion-based speech/audio denoise	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/diffusion_based_speech_audio_denoise.py</code>	None (generic/default path)	None
<code>denoise_and_restoration.declip_via_sparse_reconstruction</code>	Declip via sparse reconstruction	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/declip_via_sparse_reconstruction.py</code>	<code>clip_threshold</code>	Declip
<code>denoise_and_restoration.declick_decrackle_median_wavelet_interpolation</code>	Declick/decrackle (median/wavelet + interpolation)	<code>core</code>	<code>src/pvx/algorithms/denoise_and_restoration/declick_decrackle_median_wavelet_interpolation.py</code>	<code>spike_threshold</code>	Declick

pvx Group: Dereverb and Room Correction

Source: groups/dereverb_and_room_correction.html

Theme: Dereverb and Room Correction

Folder: `dereverb_and_room_correction` | **Algorithms:** 8

Subgroups: `core` (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>dereverb_and_room_correction.wpe_dereverberation</code>	WPE dereverberation	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/wpe_dereverberation.py</code>	<code>taps</code> , <code>delay</code>	Dereverberation
<code>dereverb_and_room_correction.spectral_decay_subtraction</code>	Spectral decay subtraction	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/spectral_decay_subtraction.py</code>	None (generic/default path)	None
<code>dereverb_and_room_correction.late_reverb_suppression_via_coherence</code>	Late reverb suppression via coherence	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/late_reverb_suppression_via_coherence.py</code>	None (generic/default path)	None
<code>dereverb_and_room_correction.room_impulse_inverse_filtering</code>	Room impulse inverse filtering	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/room_impulse_inverse_filtering.py</code>	None (generic/default path)	None
<code>dereverb_and_room_correction.multi_band_adaptive_dereverb</code>	Multi-band adaptive dereverb	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/multi_band_adaptive_dereverb.py</code>	None (generic/default path)	None
<code>dereverb_and_room_correction.drr_guided_dereverb</code>	DRR-guided dereverb	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/drr_guided_dereverb.py</code>	None (generic/default path)	None
<code>dereverb_and_room_correction.blind_deconvolution_dereverb</code>	Blind deconvolution dereverb	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/blind_deconvolution_dereverb.py</code>	None (generic/default path)	Blind deconvolution
<code>dereverb_and_room_correction.neural_dereverb_module</code>	Neural dereverb module	<code>core</code>	<code>src/pvx/algorithms/dereverb_and_room_correction/neural_dereverb_module.py</code>	None (generic/default path)	None

pvx Group: Dynamics and Loudness

Source: groups/dynamics_and_loudness.html

Theme: Dynamics and Loudness

Folder: `dynamics_and_loudness` | **Algorithms:** 8

Subgroups: `core` (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>dynamics_and_loudness.ebu_r128_normalization</code>	EBU R128 normalization	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/ebu_r128_normalization.py</code>	<code>target_lufs</code>	EBU R128
<code>dynamics_and_loudness.itu_bs_1770_loudness_measurement_gating</code>	ITU BS.1770 loudness measurement/gating	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/itu_bs_1770_loudness_measurement_gating.py</code>	<code>gate_lufs</code>	None
<code>dynamics_and_loudness.multi_band_compression</code>	Multi-band compression	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/multi_band_compression.py</code>	None (generic/default path)	None
<code>dynamics_and_loudness.upward_compression</code>	Upward compression	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/upward_compression.py</code>	<code>threshold_db, ratio</code>	None
<code>dynamics_and_loudness.transient_shaping</code>	Transient shaping	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/transient_shaping.py</code>	<code>attack_db, sustain</code>	None
<code>dynamics_and_loudness.spectral_dynamics_bin_wise_compressor_expander</code>	Spectral dynamics (bin-wise compressor/expander)	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/spectral_dynamics_bin_wise_compressor_expander.py</code>	<code>threshold_db, ratio</code>	Compressor, Expander
<code>dynamics_and_loudness.true_peak_limiting</code>	True-peak limiting	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/true_peak_limiting.py</code>	<code>threshold</code>	True peak
<code>dynamics_and_loudness.lufs_target_mastering_chain</code>	LUFS-target mastering chain	<code>core</code>	<code>src/pvx/algorithms/dynamics_and_loudness/lufs_target_mastering_chain.py</code>	<code>target_lufs</code>	LUFS

pvx Group: Granular and Modulation

Source: groups/granular_and_modulation.html

Theme: Granular and Modulation

Folder: `granular_and_modulation` | **Algorithms:** 8

Subgroups: `core` (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>granular_and_modulation.granular_time_stretch_engine</code>	Granular time-stretch engine	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/granular_time_stretch_engine.py</code>	<code>stretch</code> , <code>grain</code> , <code>hop</code>	None
<code>granular_and_modulation.grain_cloud_pitch_textures</code>	Grain-cloud pitch textures	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/grain_cloud_pitch_textures.py</code>	<code>seed</code> , <code>grain</code> , <code>count</code> , <code>stretch</code>	None
<code>granular_and_modulation.freeze_grain_morphing</code>	Freeze-grain morphing	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/freeze_grain_morphing.py</code>	<code>grain</code> , <code>start</code>	None
<code>granular_and_modulation.am_fm_ring_modulation_blocks</code>	AM/FM/ring modulation blocks	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/am_fm_ring_modulation_blocks.py</code>	<code>freq_hz</code> , <code>fm_depth</code>	Ring modulation
<code>granular_and_modulation.spectral_tremolo</code>	Spectral tremolo	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/spectral_tremolo.py</code>	<code>lfo_hz</code>	None
<code>granular_and_modulation.formant_lfo_modulation</code>	Formant LFO modulation	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/formant_lfo_modulation.py</code>	<code>lfo_hz</code>	Formant, LFO
<code>granular_and_modulation.rhythmic_gate_stutter_quantizer</code>	Rhythmic gate/stutter quantizer	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/rhythmic_gate_stutter_quantizer.py</code>	<code>rate_hz</code> , <code>duty</code>	None
<code>granular_and_modulation.envelope_followed_modulation_routing</code>	Envelope-followed modulation routing	<code>core</code>	<code>src/pvx/algorithms/granular_and_modulation/envelope_followed_modulation_routing.py</code>	<code>depth</code>	None

pvx Group: Pitch Detection and Tracking

Source: groups/pitch_detection_and_tracking.html

Theme: Pitch Detection and Tracking

Folder: `pitch_detection_and_tracking` | **Algorithms:** 8

Subgroups: `core` (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>pitch_detection_and_tracking.yin</code>	YIN	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/yin.py</code>	None (generic/default path)	YIN
<code>pitch_detection_and_tracking.pyin</code>	pYIN	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/pyin.py</code>	None (generic/default path)	pYIN
<code>pitch_detection_and_tracking.rapt</code>	RAPT	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/rapt.py</code>	None (generic/default path)	RAPT
<code>pitch_detection_and_tracking.swipe</code>	SWIPE	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/swipe.py</code>	None (generic/default path)	SWIPE
<code>pitch_detection_and_tracking.harmonic_product_spectrum_hps</code>	Harmonic Product Spectrum (HPS)	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/harmonic_product_spectrum_hps.py</code>	None (generic/default path)	Harmonic product spectrum
<code>pitch_detection_and_tracking.subharmonic_summation</code>	Subharmonic summation	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/subharmonic_summation.py</code>	None (generic/default path)	Subharmonic summation
<code>pitch_detection_and_tracking.crepe_style_neural_f0</code>	CREPE-style neural F0	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/crepe_style_neural_f0.py</code>	None (generic/default path)	None
<code>pitch_detection_and_tracking.viterbi_smoothed_pitch_contour_tracking</code>	Viterbi-smoothed pitch contour tracking	<code>core</code>	<code>src/pvx/algorithms/pitch_detection_and_tracking/viterbi_smoothed_pitch_contour_tracking.py</code>	<code>root_midi</code> , <code>scale_cents</code> , <code>scale</code> , <code>fmin</code> , <code>fmax</code>	None

pvx Group: Retune and Intonation

Source: groups/retune_and_intonation.html

Theme: Retune and Intonation

Folder: `retune_and_intonation` | **Algorithms:** 8

Subgroups: `core` (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>retune_and_intonation.chord_aware_retuning</code>	Chord-aware retuning	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/chord_aware_retuning.py</code>	<code>strength</code>	None
<code>retune_and_intonation.key_aware_retuning_with_confidence_weighting</code>	Key-aware retuning with confidence weighting	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/key_aware_retuning_with_confidence_weighting.py</code>	None (generic/default path)	None
<code>retune_and_intonation.just_intonation_mapping_per_key_center</code>	Just intonation mapping per key center	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/just_intonation_mapping_per_key_center.py</code>	None (generic/default path)	Just intonation
<code>retune_and_intonation.adaptive_intonation_context_sensitive_intervals</code>	Adaptive intonation (context-sensitive intervals)	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/adaptive_intonation_context_sensitive_intervals.py</code>	None (generic/default path)	None
<code>retune_and_intonation.scala_mts_scale_import_and_quantization</code>	Scala/MTS scale import and quantization	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/scala_mts_scale_import_and_quantization.py</code>	None (generic/default path)	None
<code>retune_and_intonation.time_varying_cents_maps</code>	Time-varying cents maps	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/time_varying_cents_maps.py</code>	<code>cents_curve</code>	Cents
<code>retune_and_intonation.vibrato_preserving_correction</code>	Vibrato-preserving correction	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/vibrato_preserving_correction.py</code>	<code>strength</code>	None
<code>retune_and_intonation.portamento_aware_retune_curves</code>	Portamento-aware retune curves	<code>core</code>	<code>src/pvx/algorithms/retune_and_intonation/portamento_aware_retune_curves.py</code>	<code>max_semitone_step</code> , <code>compression</code>	Portamento

pvx Group: Separation and Decomposition

Source: groups/separation_and_decomposition.html

Theme: Separation and Decomposition

Folder: separation_and_decomposition | **Algorithms:** 8

Subgroups: core (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>separation_and_decomposition.rpca_hpss</code>	RPCA HPSS	core	<code>src/pvx/algorithms/separation_and_decomposition/rpca_hpss.py</code>	None (generic/default path)	HPSS, RPCA
<code>separation_and_decomposition.nmf_decomposition</code>	NMF decomposition	core	<code>src/pvx/algorithms/separation_and_decomposition/nmf_decomposition.py</code>	components	NMF
<code>separation_and_decomposition.ica_bss_for_multichannel_stems</code>	ICA/BSS for multichannel stems	core	<code>src/pvx/algorithms/separation_and_decomposition/ica_bss_for_multichannel_stems.py</code>	None (generic/default path)	ICA
<code>separation_and_decomposition.sinusoidal_residual_transient_decomposition</code>	Sinusoidal+residual+transient decomposition	core	<code>src/pvx/algorithms/separation_and_decomposition/sinusoidal_residual_transient_decomposition.py</code>	None (generic/default path)	None
<code>separation_and_decomposition.demucs_style_stem_separation_backend</code>	Demucs-style stem separation backend	core	<code>src/pvx/algorithms/separation_and_decomposition/demucs_style_stem_separation_backend.py</code>	None (generic/default path)	Demucs
<code>separation_and_decomposition.u_net_vocal_accompaniment_split</code>	U-Net vocal/accompaniment split	core	<code>src/pvx/algorithms/separation_and_decomposition/u_net_vocal_accompaniment_split.py</code>	None (generic/default path)	U-Net
<code>separation_and_decomposition.tensor_decomposition_cp_tucker</code>	Tensor decomposition (CP/Tucker)	core	<code>src/pvx/algorithms/separation_and_decomposition/tensor_decomposition_cp_tucker.py</code>	rank	Tensor decomposition

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
separation_and_decomposition.probabilistic_latent_component_separation	Probabilistic latent component separation	core	src/pvx/algorithms/separation_and_decomposition/probabilistic_latent_component_separation.py	None (generic/default path)	None

pvx Group: Spatial and Multichannel

Source: groups/spatial_and_multichannel.html

Theme: Spatial and Multichannel

Folder: spatial_and_multichannel | **Algorithms:** 36

Subgroups: imaging_and_panning (6) beamforming_and_directionality (6) ambisonics_and_immersive (6)
phase_vocoder_spatial (6) multichannel_restoration (6) creative_spatial_fx (6)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
spatial_and_multichannel.vbap_adaptive_panning	VBAP adaptive panning	imaging_and_panning	src/pvx/algorithms/spatial_and_multichannel/imaging_and_panning/vbap_adaptive_panning.py	output_channels, azimuth_deg, width	VBAP
spatial_and_multichannel.dbap_distance_based_amplitude_panning	DBAP (distance-based amplitude panning)	imaging_and_panning	src/pvx/algorithms/spatial_and_multichannel/imaging_and_panning/dbap_distance_based_amplitude_panning.py	output_channels, source_x, source_y, rolloff	DBAP
spatial_and_multichannel.binaural_itd_ilid_synthesis	Binaural ITD/ILD synthesis	imaging_and_panning	src/pvx/algorithms/spatial_and_multichannel/imaging_and_panning/binaural_itd_ilid_synthesis.py	azimuth_deg, itd_max_ms, ild_db	None
spatial_and_multichannel.transaural_crosstalk_cancellation	Transaural crosstalk cancellation	imaging_and_panning	src/pvx/algorithms/spatial_and_multichannel/imaging_and_panning/transaural_crosstalk_cancellation.py	cancellation, delay_ms	Crosstalk cancellation
spatial_and_multichannel.stereo_width_frequency_dependent_control	Stereo width (frequency-dependent control)	imaging_and_panning	src/pvx/algorithms/spatial_and_multichannel/imaging_and_panning/stereo_width_frequency_dependent_control.py	width_low, width_high, crossover_hz	None
spatial_and_multichannel.phase_aligned_mid_side_field_rotation	Phase-aligned mid/side field rotation	imaging_and_panning	src/pvx/algorithms/spatial_and_multichannel/imaging_and_panning/phase_aligned_mid_side_field_rotation.py	rotation_deg	None
spatial_and_multichannel.delay_and_sum_beamforming	Delay-and-sum beamforming	beamforming_and_directionality	src/pvx/algorithms/spatial_and_multichannel/beamforming_and_directionality/delay_and_sum_beamforming.py	steer_deg, spacing_m, sound_speed	Beamforming

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>spatial_and_multichannel.mvdr_beamformer_wideband</code>	MVDR beamformer (wideband)	<code>beamforming_and_directionality</code>	<code>src/pvx/algorithms/spatial_and_multichannel/beamforming_and_directionality/mvdr_beamformer_wideband.py</code>	<code>steer_deg</code> , <code>spacing_m</code> , <code>sound_speed</code> , <code>diag_load</code>	Beamforming, MVDR beamformer
<code>spatial_and_multichannel.generalized_sidelobe_canceller</code>	Generalized sidelobe canceller	<code>beamforming_and_directionality</code>	<code>src/pvx/algorithms/spatial_and_multichannel/beamforming_and_directionality/generalized_sidelobe_canceller.py</code>	<code>mu</code> , <code>steer_deg</code> , <code>spacing_m</code> , <code>sound_speed</code>	Beamforming
<code>spatial_and_multichannel.superdirective_beamformer</code>	Superdirective beamformer	<code>beamforming_and_directionality</code>	<code>src/pvx/algorithms/spatial_and_multichannel/beamforming_and_directionality/superdirective_beamformer.py</code>	<code>steer_deg</code> , <code>spacing_m</code> , <code>sound_speed</code> , <code>aperture</code>	Beamforming
<code>spatial_and_multichannel.diffuse_field_coherence_masking</code>	Diffuse-field coherence masking	<code>beamforming_and_directionality</code>	<code>src/pvx/algorithms/spatial_and_multichannel/beamforming_and_directionality/diffuse_field_coherence_masking.py</code>	<code>coherence_threshold</code> , <code>floor</code>	Beamforming, Diffuse field
<code>spatial_and_multichannel.direction_of_arrival_grid_tracking</code>	Direction-of-arrival grid tracking	<code>beamforming_and_directionality</code>	<code>src/pvx/algorithms/spatial_and_multichannel/beamforming_and_directionality/direction_of_arrival_grid_tracking.py</code>	<code>spacing_m</code> , <code>sound_speed</code> , <code>frame</code> , <code>hop</code>	Beamforming
<code>spatial_and_multichannel.first_order_ambisonic_encode_decode</code>	First-order ambisonic encode/decode	<code>ambisonics_and_immersive</code>	<code>src/pvx/algorithms/spatial_and_multichannel/ambisonics_and_immersive/first_order_ambisonic_encode_decode.py</code>	<code>azimuth_deg</code> , <code>elevation_deg</code>	Ambisonics
<code>spatial_and_multichannel.higher_order_ambisonic_rotation</code>	Higher-order ambisonic rotation	<code>ambisonics_and_immersive</code>	<code>src/pvx/algorithms/spatial_and_multichannel/ambisonics_and_immersive/higher_order_ambisonic_rotation.py</code>	<code>yaw_deg</code>	Ambisonics
<code>spatial_and_multichannel.ambisonic_binaural_rendering</code>	Ambisonic binaural rendering	<code>ambisonics_and_immersive</code>	<code>src/pvx/algorithms/spatial_and_multichannel/ambisonics_and_immersive/ambisonic_binaural_rendering.py</code>	<code>head_itd_ms</code> , <code>head_ilv_db</code> , <code>azimuth_deg</code>	Ambisonics, Binaural rendering

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>spatial_and_multichannel.spherical_harmonic_diffuse_enhancement</code>	Spherical-harmonic diffuse enhancement	<code>ambisonics_and_immersive</code>	<code>src/pvx/algorithms/spatial_and_multichannel/ambisonics_and_immersive/spherical_harmonic_diffuse_enhancement.py</code>	<code>diffuse_mix</code>	Ambisonics
<code>spatial_and_multichannel.hoa_order_truncation_and_upmix</code>	HOA order truncation and upmix	<code>ambisonics_and_immersive</code>	<code>src/pvx/algorithms/spatial_and_multichannel/ambisonics_and_immersive/hoa_order_truncation_and_upmix.py</code>	<code>target_channels</code>	Ambisonics
<code>spatial_and_multichannel.spatial_room impulse_convolution</code>	Spatial room impulse convolution	<code>ambisonics_and_immersive</code>	<code>src/pvx/algorithms/spatial_and_multichannel/ambisonics_and_immersive/spatial_room_impulse_convolution.py</code>	<code>decay_s</code> , <code>rir_length</code> , <code>seed</code>	Convolution, Ambisonics
<code>spatial_and_multichannel.pvx_interchannel_phase_locking</code>	pvx interchannel phase locking	<code>phase_vocoder_spatial</code>	<code>src/pvx/algorithms/spatial_and_multichannel/phase_vocoder_spatial/pvx_interchannel_phase_locking.py</code>	<code>lock_strength</code>	Phase vocoder, Phase locking
<code>spatial_and_multichannel.pvx_spatial_transient_preservation</code>	pvx spatial transient preservation	<code>phase_vocoder_spatial</code>	<code>src/pvx/algorithms/spatial_and_multichannel/phase_vocoder_spatial/pvx_spatial_transient_preservation.py</code>	<code>transient_threshold</code> , <code>phase_smooth</code> , <code>preserve_amount</code>	Phase vocoder, Transient preservation
<code>spatial_and_multichannel.pvx_interaural_coherence_shaping</code>	pvx interaural coherence shaping	<code>phase_vocoder_spatial</code>	<code>src/pvx/algorithms/spatial_and_multichannel/phase_vocoder_spatial/pvx_interaural_coherence_shaping.py</code>	<code>coherence_target</code>	Phase vocoder
<code>spatial_and_multichannel.pvx_directional_spectral_warp</code>	pvx directional spectral warp	<code>phase_vocoder_spatial</code>	<code>src/pvx/algorithms/spatial_and_multichannel/phase_vocoder_spatial/pvx_directional_spectral_warp.py</code>	<code>warp_amount</code> , <code>azimuth_deg</code>	Phase vocoder
<code>spatial_and_multichannel.pvx_multichannel_time_alignment</code>	pvx multichannel time alignment	<code>phase_vocoder_spatial</code>	<code>src/pvx/algorithms/spatial_and_multichannel/phase_vocoder_spatial/pvx_multichannel_time_alignment.py</code>	<code>max_lag</code>	Phase vocoder

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>spatial_and_multichannel.pvx_spatial_freeze_and_trajectory</code>	pvx spatial freeze and trajectory	<code>phase_vocoder_spatial</code>	<code>src/pvx/algorithms/spatial_and_multichannel/phase_vocoder_spatial/pvx_spatial_freeze_and_trajectory.py</code>	<code>frame_ratio</code> , <code>orbit_hz</code>	Phase vocoder
<code>spatial_and_multichannel.multichannel_wiener_postfilter</code>	Multichannel Wiener postfilter	<code>multichannel_restoration</code>	<code>src/pvx/algorithms/spatial_and_multichannel/multichannel_restoration/multichannel_wiener_postfilter.py</code>	<code>noise_floor</code>	None
<code>spatial_and_multichannel.coherence_based_dereverb_multichannel</code>	Coherence-based dereverb (multichannel)	<code>multichannel_restoration</code>	<code>src/pvx/algorithms/spatial_and_multichannel/multichannel_restoration/coherence_based_dereverb_multichannel.py</code>	<code>coherence_threshold</code> , <code>decay</code>	None
<code>spatial_and_multichannel.multichannel_noise_psd_tracking</code>	Multichannel noise PSD tracking	<code>multichannel_restoration</code>	<code>src/pvx/algorithms/spatial_and_multichannel/multichannel_restoration/multichannel_noise_psd_tracking.py</code>	<code>alpha</code> , <code>floor</code>	None
<code>spatial_and_multichannel.phase_consistent_multichannel_denoise</code>	Phase-consistent multichannel denoise	<code>multichannel_restoration</code>	<code>src/pvx/algorithms/spatial_and_multichannel/multichannel_restoration/phase_consistent_multichannel_denoise.py</code>	<code>reduction_db</code> , <code>floor</code>	None
<code>spatial_and_multichannel.microphone_array_calibration_tones</code>	Microphone-array calibration tones	<code>multichannel_restoration</code>	<code>src/pvx/algorithms/spatial_and_multichannel/multichannel_restoration/microphone_array_calibration_tones.py</code>	<code>tone_hz</code> , <code>apply_correction</code>	None
<code>spatial_and_multichannel.cross_channel_click_pop_repair</code>	Cross-channel click/pop repair	<code>multichannel_restoration</code>	<code>src/pvx/algorithms/spatial_and_multichannel/multichannel_restoration/cross_channel_click_pop_repair.py</code>	<code>spike_threshold</code>	None
<code>spatial_and_multichannel.rotating_speaker_doppler_field</code>	Rotating-speaker Doppler field	<code>creative_spatial_fx</code>	<code>src/pvx/algorithms/spatial_and_multichannel/creative_spatial_fx/rotating_speaker_doppler_field.py</code>	<code>output_channels</code> , <code>rotation_hz</code> , <code>depth_ms</code>	None

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>spatial_and_multichannel.binaural_motion_trajectory_designer</code>	Binaural motion trajectory designer	<code>creative_spatial_fx</code>	<code>src/pvx/algorithms/spatial_and_multichannel/creative_spatial_fx/binaural_motion_trajectory_designer.py</code>	<code>trajectory</code> , <code>trajectory_hz</code> , <code>width</code> , <code>itd_ms</code>	None
<code>spatial_and_multichannel.stochastic_spatial_diffusion_cloud</code>	Stochastic spatial diffusion cloud	<code>creative_spatial_fx</code>	<code>src/pvx/algorithms/spatial_and_multichannel/creative_spatial_fx/stochastic_spatial_diffusion_cloud.py</code>	<code>output_channels</code> , <code>diffusion</code> , <code>max_delay_ms</code> , <code>seed</code>	None
<code>spatial_and_multichannel.decorrelated_reverb_upmix</code>	Decorrelated reverb upmix	<code>creative_spatial_fx</code>	<code>src/pvx/algorithms/spatial_and_multichannel/creative_spatial_fx/decorrelated_reverb_upmix.py</code>	<code>output_channels</code> , <code>decay_s</code> , <code>rir_length</code> , <code>mix</code> , <code>seed</code>	None
<code>spatial_and_multichannel.spectral_spatial_granulator</code>	Spectral spatial granulator	<code>creative_spatial_fx</code>	<code>src/pvx/algorithms/spatial_and_multichannel/creative_spatial_fx/spectral_spatial_granulator.py</code>	<code>output_channels</code> , <code>grain</code> , <code>spread_semitones</code> , <code>density</code> , <code>seed</code>	None
<code>spatial_and_multichannel.spatial_freeze_resynthesis</code>	Spatial freeze resynthesis	<code>creative_spatial_fx</code>	<code>src/pvx/algorithms/spatial_and_multichannel/creative_spatial_fx/spatial_freeze_resynthesis.py</code>	<code>output_channels</code> , <code>frame_ratio</code> , <code>phase_drift</code> , <code>transform</code>	None

pvx Group: Spectral and Time-Frequency Transforms

Source: groups/spectral_time_frequency_transforms.html

Theme: Spectral and Time-Frequency Transforms

Folder: [spectral_time_frequency_transforms](#) | **Algorithms:** 8

Subgroups: [core](#) (8)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
spectral_time_frequency_transforms.constant_q_transform_processing	Constant-Q Transform (CQT) processing	core	src/pvx/algorithms/spectral_time_frequency_transforms/constant_q_transform_cqt_processing.py	None (generic/default path)	Constant-Q transform (CQT)
spectral_time_frequency_transforms.variable_q_transform_vqt	Variable-Q Transform (VQT)	core	src/pvx/algorithms/spectral_time_frequency_transforms/variable_q_transform_vqt.py	None (generic/default path)	Variable-Q transform (VQT)
spectral_time_frequency_transforms.ngt_based_processing	NSGT-based processing	core	src/pvx/algorithms/spectral_time_frequency_transforms/ngt_based_processing.py	None (generic/default path)	NSGT
spectral_time_frequency_transforms.reassigned_spectrogram_methods	Reassigned spectrogram methods	core	src/pvx/algorithms/spectral_time_frequency_transforms/reassigned_spectrogram_methods.py	None (generic/default path)	Reassigned spectrogram
spectral_time_frequency_transforms.synchrosqueezed_stft	Synchrosqueezed STFT	core	src/pvx/algorithms/spectral_time_frequency_transforms/synchrosqueezed_stft.py	None (generic/default path)	None
spectral_time_frequency_transforms.chirplet_transform_analysis	Chirplet transform analysis	core	src/pvx/algorithms/spectral_time_frequency_transforms/chirplet_transform_analysis.py	None (generic/default path)	Chirplet transform
spectral_time_frequency_transforms.wavelet_packet_processing	Wavelet packet processing	core	src/pvx/algorithms/spectral_time_frequency_transforms/wavelet_packet_processing.py	None (generic/default path)	Wavelet packet
spectral_time_frequency_transforms.multi_window_stft_fusion	Multi-window STFT fusion	core	src/pvx/algorithms/spectral_time_frequency_transforms/multi_window_stft_fusion.py	None (generic/default path)	None

pvx Group: Time-Scale and Pitch Core

Source: groups/time_scale_and_pitch_core.html

Theme: Time-Scale and Pitch Core

Folder: `time_scale_and_pitch_core` | **Algorithms:** 7

Subgroups: `core` (7)

Algorithm ID	Name	Subgroup	Module Path	Parameter keys	Concept links
<code>time_scale_and_pitch_core.wsola_waveform_similarity_overlap_add</code>	WSOLA (Waveform Similarity Overlap-Add)	<code>core</code>	<code>src/pvx/algorithms/time_scale_and_pitch_core/wsola_waveform_similarity_overlap_add.py</code>	<code>stretch</code> , <code>grain_size</code> , <code>hop</code>	WSOLA
<code>time_scale_and_pitch_core.td_psola</code>	TD-PSOLA	<code>core</code>	<code>src/pvx/algorithms/time_scale_and_pitch_core/td_psola.py</code>	<code>semitones</code> , <code>stretch</code>	TD-PSOLA
<code>time_scale_and_pitch_core.lp_psola</code>	LP-PSOLA	<code>core</code>	<code>src/pvx/algorithms/time_scale_and_pitch_core/lp_psola.py</code>	<code>semitones</code>	LP-PSOLA
<code>time_scale_and_pitch_core.multi_resolution_phase_vocoder</code>	Multi-resolution phase vocoder	<code>core</code>	<code>src/pvx/algorithms/time_scale_and_pitch_core/multi_resolution_phase_vocoder.py</code>	<code>stretch</code>	Phase vocoder
<code>time_scale_and_pitch_core.harmonic_percussive_split_tsm</code>	Harmonic/percussive split TSM	<code>core</code>	<code>src/pvx/algorithms/time_scale_and_pitch_core/harmonic_percussive_split_tsm.py</code>	<code>harmonic_stretch</code> , <code>percussive_stretch</code>	None
<code>time_scale_and_pitch_core.beat_sync_chronous_time_warping</code>	Beat-synchronous time warping	<code>core</code>	<code>src/pvx/algorithms/time_scale_and_pitch_core/beat_sync_chronous_time_warping.py</code>	<code>stretch</code>	None
<code>time_scale_and_pitch_core.nonlinear_time_maps</code>	Nonlinear time maps (curves, anchors, spline timing)	<code>core</code>	<code>src/pvx/algorithms/time_scale_and_pitch_core/nonlinear_time_maps.py</code>	<code>curve</code> , <code>stretch</code> , <code>fmin</code> , <code>fmax</code>	None