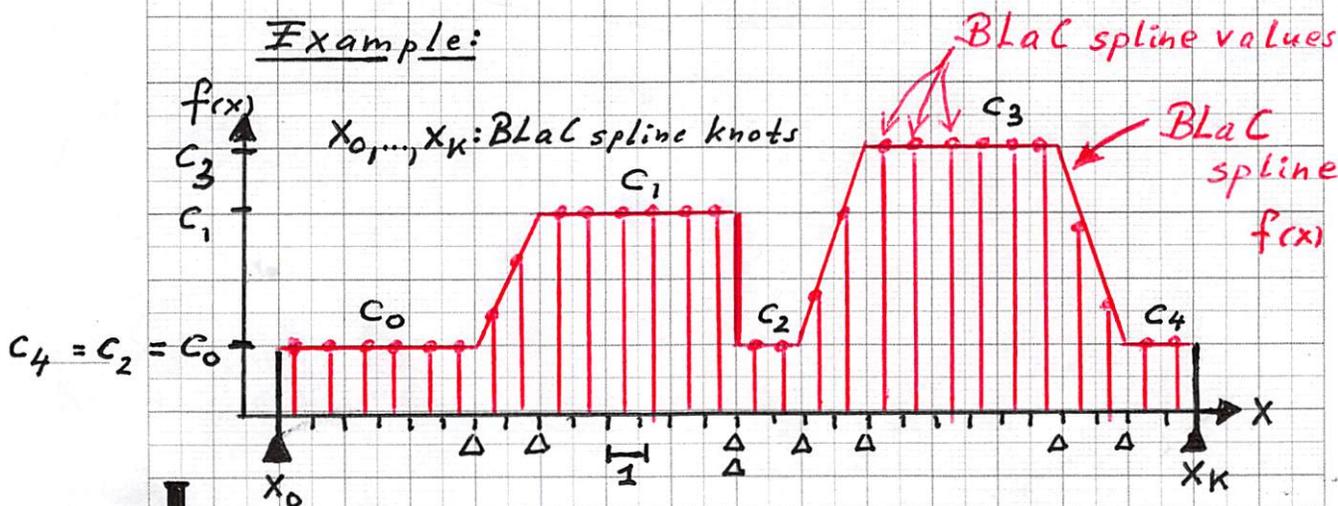■ <u>Best BLaC Spline Image Approximation: Advantages</u>

→ Significant <u>IMPROVEMENT</u> of <u>HISTOGRAMS</u> (and histogram-based feature signatures) of differential image properties (intensity values, $1^{st}$ & $2^{nd}$ derivatives, ...)
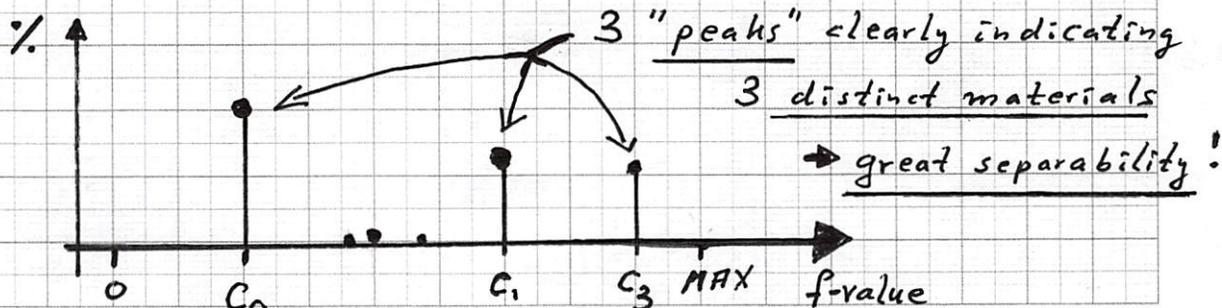
<u>Example:</u>



$X_0, ..., X_K$: BLaC spline knots

BLaC spline values

BLaC spline $f(x)$

• Here:
$$f(x) = \sum_{i=0}^{4} c_i f_i(x)$$

▲  end knots

△  interior knots

△̲  double knots ("infinite-slope ramp")

• $f(x)$ evaluated at midpoints of each unit interval in x-domain

HISTOGRAM



3 "peaks" clearly indicating 3 distinct materials

→ <u>great separability</u>!

→ <u>USE MANY BINS!</u>

■ Best BLaC Spline – Cont'd.

➡ BLaC spline can be evaluated using ANY GRID TYPE (Cartesian,...) using ANY RESOLUTION.

➡ BLaC spline completely defined by KNOTS $\{x_0,...,x_K\}$ and COEFFICIENTS $\{c_0,...,c_n\}$;
(1) BLaC spline representation = DATA COMPRESSION;
(2) BLaC spline (characteristics) could be used directly to define FEATURES of data (→ usable for classification?).

➡ 'Large' BLaC spline PLATEAUS define sharp PEAKS/SPIKES in HISTOGRAM indicating MATERIAL TYPE. (See previous page.)

➡ Differential properties of a BLaC spline can be 'enriched' by using values of the spline and FINITE DIFFERENCE FORMULAS to generate measures of HIGHER-ORDER DIFFERENTIAL BEHAVIOR of modeled data.



➡ BLaC spline:
$f' = 0$ (plateau) or $f' \neq 0$ (ramp)
$f'' = f''' = ... = 0$

➡ BUT: FINITE DIFFERENCES OF • VALUES DEFINE 'HELPFUL' 1st, 2nd, 3rd DERIVATIVES AT ENDS OF PLATEAUS (i.e., material interfaces)
≈ BH

➡ Compute $f''$ estimates here (finite differences)

!!! ➡ THIN OBJECTS: NO OR HARDLY ANY PLATEAU PIXELS WITH $f'$ ESTIMATE ZERO