Lausanne, August 19, 2004

Dear Dr. Liebling,

I am pleased to inform you that you were selected to receive the 2004 Research Award of the Swiss Society of Biomedical Engineering for your thesis work "On Fresnelets, interference fringes, and digital holography". The award will be presented during the general assembly of the SSBE, September 3, Zurich, Switzerland.

Please, let us know if
1) you will be present to receive the award,
2) you would be willing to give a 10 minutes presentation of the work during the general assembly.

The award comes with a cash prize of 1000.- CHF. Would you please send your banking information to the treasurer of the SSBE, Uli Diermann (Email: uli.diermann@bfh.ch), so that he can transfer the cash prize to your account?

I congratulate you on your achievement.

With best regards,
Michael Unser, Professor
Chairman of the SSBE Award Committee

cc: Ralph Mueller, president of the SSBE; Uli Diermann, treasurer

Dr. Michael Liebling
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Samedi 31 janvier — dimanche 1er février 1981
LAUSANNE

NOUVEAUX DIPLOMÉS À L’EPFL
Science et conscience

Un institut interdépartemental de microélectronique, un échange avec la Carnegie Mellon University, une garde-Cerini, le département de chimie qui prend le large de côté d’Ecole, des master et des Chaus qui guetent aux vertus lomaines, un tout-simplement cycle en informatique technique, l’énergie solaire à la mèche, un championnat de planche à voile, et 171 nouveaux diplômés ! Batail dressée par M. Bernard Vittaz, président de l’EPFL, lors de la cérémonie de remise des diplômes qui a eu lieu hier soir à Lausanne, en présence de nombreux personnalités du monde politique et universitaire connue.

« Mieux habité à faire des menus rouliers que des menus de cravate » a prétendu M. Pierre Nicod, portant au nom des ingénieurs du grade rural de sa voûte, les nouveaux diplômés est désormais pour tâche de créer, avec les mécénas épars d’un savoir tout-à-fait, une machine qui concilie la sciences rigoureuse et l’approche humaine, la formation reçue et celle acquise par l’expérience sur le terrain de leurs recherches. A cette lourde transformation de jeunes étudiants en ingénieurs et architectes responsables, l’EPFL a contribué ainsi largement que possible. Il appartient alors à chacun d’en faire l’usage que le commerce, le genre des responsabilités et la curiosité toujours en éveil lui dicteront. — A
Interactions between actin and myosin filaments in skeletal muscle visualized in frozen-hydrated thin sections

B. L. Trus,* A. C. Steven,† A. W. McDowall,‡ M. Unser,§ J. Dubochet,¶ and R. J. Podolsky†

INTRODUCTION

According to the “sliding filament” theory (1-3), muscles involve the mechanism whereby two interdigitating systems of inextensible protein filaments slide past each other into a condition of allosteric activation. How force generation is mediated by “cross-bridges” that couple transiently with adjacent actin filaments. How cross-bridges in situ move outwards (suspect preservation of native conformation) and applied them to cryosections. For the purpose of inferring net interfilament interactions in the myofilament lattice, perhaps the most revealing accumulation of density around the actin filament. The redistribution of mass represents attachment of the cross-bridges in situ move outwards even without actin in their immediate proximity.

Jacques Dubochet, Joachim Frank, Richard Henderson

Nobel Prize in Chemistry 2017

"for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution"
B-Spline Signal Processing: Part I—Theory
Michael Unser, Member, IEEE, Akeem Aldabbashi, and Murray Eden, Life Fellow, IEEE

Abstract—This paper describes a set of efficient filtering techniques for the processing and representation of signals in terms of continuous B-spline basis functions. We first consider the convolution of a B-spline function with a discrete filter. We then consider the convolution of a B-spline function with a continuous filter with the help of the convolution of the sampled B-spline function with a sequence of discrete filters. This approach allows the approximation of continuous B-spline functions and the representation of continuous B-spline functions by discrete B-spline functions. We also develop an algorithm for the efficient generation of B-spline functions and B-spline functions. Edge detection is a useful example of the use of a continuous signal representation, particularly for images. Most algorithms are based on the evaluation of spatial gradients or Laplacians [3]. Early techniques relied on finite differences to estimate these quantities [4]. However, these simple operators used for noisy images perform poorly. More recent approaches often depend on the concept of fitting a continuous surface locally to the data [5], [10]. Nevertheless, local least squares polynomial fit to determine the zero-crossing of the second directional derivative [9]. Poggio et al. proposed a smoothing cubic spline technique to improve the estimation of the intensity gradient in the presence of noise [9], [11]. These authors showed the approach to be more or less equivalent to smoothing the image with a Gaussian low-pass filter in a preprocessing step. In fact, an initial smoothing operation is implicit to all least squares techniques and is used in almost any modern edge detection.
1991-93: Splines and wavelets

A family of polynomial spline wavelet transforms

Michael Unser, Akeem Alabdulla and Mustafa ElZai

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Abstract. This paper presents an overview of the family of orthogonal (filter) spline-wavelet transforms with emphasis on their basic architecture. Spline wavelets that are not necessarily orthogonal are considered as well as the corresponding orthonormal splines. The expression for compact support (9-point) symmetric splines is given in Table 1, and the corresponding wavelet transforms are presented in Table 2. The orthonormal spline wavelets with compact support are well suited for the dual wavelet expansion and dual wavelet decomposition, which are utilized in the construction of the wavelet transform. The wavelet transform is shown to be a generalization of the classical wavelet transform with compact support. The corresponding dual wavelet expansion is obtained by translating and dilating the wavelet basis, which is constructed from the wavelet coefficients. The wavelet representation is shown to be a very effective tool for signal processing.

The corresponding wavelet expansion can be obtained by translating and dilating the wavelet basis, which is constructed from the wavelet coefficients. The wavelet expansion is shown to be a very effective tool for signal processing.

\[ \psi(x) = \frac{1}{\sqrt{2}} \psi(2x - k) \]

This expression can be used to obtain the expansion coefficients by the simple formula:

\[ d_n(x) = \int_{-\infty}^{\infty} h_n(x) \psi(2^n x - k) \, dx \]

\[ h_n(x) = \sum_{k=-\infty}^{\infty} d_n(x-k) \]

\[ \psi_n(x) = \sum_{k=-\infty}^{\infty} h_n(x-k) \psi(2^n x - k) \]

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\[ h_n(x) = \sum_{k=-\infty}^{\infty} d_n(x-k) \psi(2^n x - k) \]
A Review of Wavelets in Biomedical Applications

MICHAEL UNSER, SENIOR MEMBER, IEEE, AND AKRAM ALDROUBI

Invited Paper

In this paper, we present an overview of the various uses of the wavelet transform (WF) in medicine and biology. We start by describing the main features that are the most important for biomedical applications of wavelets and provide some comparisons of the advantages of the transform over classical techniques. Wavelet transforms are a powerful tool that can be used to analyze and process signals and images in a variety of applications. They are particularly useful in the analysis of biomedical signals, where they can be used to extract meaningful information from data that is often noisy and complex.

1. INTRODUCTION

The main difficulty in dealing with biomedical signals is the extreme variability of the signals and the necessity to operate on a case-by-case basis. Often, one does not know a priori what is the pertinent information and/or at which scale it is located. For example, it is frequently the case that some signal features from the normal that is the most relevant information for diagnosis. As a result, the problem is to be less well-defined than those in engineering and the emphasis is more on designing robust methods that work in most circumstances, rather than procedures that are optimal under very specific assumptions. Another important aspect of biomedical signals is that the information of interest is often a combination of features that are well localized temporally or spatially (e.g., spikes and transitions in electromyography (EMG) signals and ultrasonic echoes in sonography) and others that are more diffuse (e.g., small oscillations, parts, and textures). This requires the use of analysis methods sufficiently versatile to handle events that may be at opposite extremes in terms of their time-frequency localization.
BIG’s research agenda

- Mathematical imaging
- Splines
- Wavelets

Medical imaging

Advanced image processing in biology

Theoretical aspects
One BIG Memory: going fractional

IEEE Signal Processing Magazine

Splines
A Perfect Fit for a scientific career

June 2028++