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| **SUBARNA TRIPATHI** | [stripathi@ucsd.edu](mailto:stripathi@ucsd.edu)  858-999-5306  <http://acsweb.ucsd.edu/~stripath/research>  <https://github.com/subtri> |
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**Profile**

A **PhD** candidate in **University of California San Diego** doing research in **computer vision** (Electrical and Communication Engineering), with 7.5years of industrial R&D experience.

**Skill Set**

Object detection, Video segmentation, Deep Learning, Image and Video Processing, Video codecs, C, MATLAB

**Professional Experience**

**Google Research and Machine Intelligence, Seattle, USA** (Research Intern - June’16 to September’16)

* People Instance Segmentation: The project was about deep learning based people instance segmentation.

**Microsoft Research, Redmond, USA** (Research Intern - June’15 to September’15)

* Eye Tracking: The project was about eye tracking for VR systems – algorithm design and C# implementation.

**STMicroelectronics Ltd, (Noida, Bangalore), India** (Technical Leader - May’06 to October’12)

* Computer Vision & Machine Learning:2D to 3D video conversion Algorithm – design and implementation in C,Object Detection & Tracking - MATLAB prototype and OpenCV + Cimplementation
* Compression:Stereo SEI messages-based proprietary AVC Encoder design, different Transcoding algorithms for H.264 & MPEG4and novel rate-control algorithm forvideo Transcoding – C implementation.
* Computational Photography: Project Definition for Rich 3D (Light Field & HDR)capture/Render technologies
* Technical reports, patent proposals, papers and tutorial presentation to different ST product groups in different geos, Mentoring junior team-members and students (trainees)

**Interra systems, Noida, India** (Member of Technical staff - July 2005 to May 2006)

≈ Designed & Developed the ATSC module; MP4/3gpanalyser and Trace Viewer in *H.264 Analyser project (Vega)*

**Education**

* **University of California San Diego** (Graduate Student Researcher, since June 2013)
  + **PhD**, Electrical and Computer Engineering(GPA 3.9/4, expected graduation date 2018)
  + **Harnessing Video for Improved Object Detection and Segmentation**
  + Supervised by Prof. Truong Nguyen and Prof. Serge Belongie
* **Indian Institute of Technology Delhi, India**
  + Master of Science (Research),Electrical Engineering, 2011, CGPA 9.653/10
  + Thesis on“**ROI based Parametric Video Coding Scheme**”
  + Supervised by Prof. Santanu Chaudhury and Dr. Sumantra Dutta Roy
* **West Bengal University of Technology, India**
  + **Bachelor of Technology,** Computer Science & Engineering, 2005, CGPA 9.01/10

**Selected Publications**

Papers

[7] S. Tripathi, M. Collins, M. Brown, and S. Belongie, "Pose2Instance: Harnessing Keypoints for Person Instance Segmentation ", under review

[6] S. Tripathi and B. Guenter, "A Statistical Approach to Continuous Self-Calibrating Eye Gaze Tracking for Head-Mounted Virtual Reality Systems ", accepted for publication in [WACV 2017](http://www.wacv17.org/), Santa Rosa, CA

[5] "Context Matters : Refining Object Detection in Video with Recurrent Neural Networks", S. Tripathi, Z. Lipton, S. Belongie and T. Nguyen, [BMVC 2016](http://bmvc2016.cs.york.ac.uk/), York, UK.

[4] S. Tripathi, S. Belongie, Y. Hwang and T. Nguyen, "Detecting Temporally Consistent Objects in Videos through Object Class Label Propagation", [WACV 2016](http://www.wacv16.org/), Lake Placid, NY

[3] S. Tripathi, S. Belongie, Y. Hwang and T. Nguyen, "Semantic Video Segmentation: Exploring Inference Efficiency", in proc IEEE ISOCC 2015, Korea.

[2] B. Kang, S. Tripathi, and T. Nguyen, "Real-time Sign Language Fingerspelling Recognition using Convolutional Neural Networks from Depth map", in proc [ACPR 2015](http://acpr2015.org/), Malaysia.

[1] S. Tripathi, Y. Hwang, S. Belongie, and T. Nguyen, “[Improving Streaming Video Segmentation with Early and Mid-Level Visual Processing](http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=6836063&queryText%3Dsubarna+tripathi+improving+streaming)”, WACV 2014, Steamboat, CO

Patents

[4] US Patent [US 9,245,200 B2, DoP Jan 26, 2016] “Method for Detecting a Straight Line in a Digital Image”

[3] US Patent [US 8848802 B2, DoP Sept 30, 2014] “Framework for Object-Based Parametric Video Compression”

[2] US Patent [US8913658 B2, DoP Dec 16, 2014] “GOP-Independent Dynamic Transcoder Bitrate Controller”, solution went to the firmware of STB chip ST7109 and ST72XX

[1] US Patent [US9197903 B2, DoP Nov 24, 2015] “A Method and System for Determining A Macroblock Partition For Data Transcoding”, solution already went to the firmware of STB chip ST71XX

Workshops

[2] “Context Matters : Refining Object Detection in Video with Recurrent Neural Networks", S. Tripathi, Z. Lipton, S. Belongie and T. Nguyen” in 2016 NIPS workshop WiML.

[1] “Beyond Semantic Image Segmentation: Exploring Efficient Inference in Video” in 2015 CVPR workshop WiCV.

Book Chapter:

[B1] “Animation and Flash Overview” for the book “Computer Graphics Multimedia and Animation” published by Prentice Hall of India; authored by Dr. Malay Pakhira (ISBN: 978-8120333446)

**Websites**

**Patents:** [**All Patents**](https://www.google.com/search?tbo=p&tbm=pts&hl=en&q=ininventor:subarna+ininventor:tripathi&num=10)

**Publications:** [**List of all papers**](http://acsweb.ucsd.edu/~stripath/research/publication.html)

**Linkedin:** [**https://www.linkedin.com/in/subarnatripathi**](https://www.linkedin.com/in/subarnatripathi)

**Github:** [**https://github.com/subarnatripathi**](https://github.com/subarnatripathi)

**Homepage:** [**http://acsweb.ucsd.edu/~stripath/research**](http://acsweb.ucsd.edu/~stripath/research)

**Courses**

**UC San Diego** ≈ Computer Vision, Learning Algorithms, Convex Optimization, Filter banks and wavelets, Probabilistic reasoning, Digital Signal Processing, Pattern Recognition, Distances-Similarities-Embeddings

**IIT Delhi (2007 to 2009, India)** ≈ Computer Vision, Image analysis, Multimedia Systems, Signal Processing, Systems Software, Video Compression

**Online Courses** (**Stanford University, Coursera)** ≈ Machine Learning, Artificial Intelligence, Computer vision, Probabilistic Graphical Model, Computational Photography

**International Summer School on Computer Vision (ICVSS) (July 2011, Italy)** ≈ Computer Vision

**Yahoo Summer School on Machine Learning (June 2010, India)** ≈ Machine Learning

**Co-curricular and extra-curricular Activities**

- IEEE Student Member, 2014 onwards

- Tutorials on Holography, Glassless 3D display, 3DTV, Video codecs, Machine Learning to different groups in India and EU

- Technical Program Committee member of International Conferences

- Mentoring students for their B.Tech project (“YUV sequence Viewer” awarded TCS-best project)

- National Scholarship of merit in 1999 (10th board exam) and 2001(12th Board exams)

- Participation in several International workshops and summer schools (computer vision, machine learning)

**Personal Details**

* Date of Birth : 16th March 1983
* Address : San Diego, CA

**ANNEXURE OF PROJECTS**

**UC San Diego**

**Object Detection and Segmentation in Video**

My research focuses on learning unsupervised and supervised models for video signal processing. Our approach of streaming hierarchical supervoxel segmentation (StreamGBH+), which is about segmenting regions in video and associating labels based on features and contextual information, achieved state-of-the-art performance. For object detection in video, I explored object proposals generation and deep learning methods for object recognition in video. My current research focuses on end-to-end weakly supervised model learning for video object detection. I also worked for efficient semantic segmentation in video where every pixel labeled with the associated category type.

**Microsoft Research**

**Eye Tracking**

I worked on self-calibrating real-time eye-gaze tracking systems for VR applications.

**ST – IIT Delhi Collaboration**

**ROI-based Parametric Video Compression (MS Thesis)**

This Project is about developing a unique Region Of Interest (ROI)-based video coding framework. ROIs are detected automatically in video, those are then tracked by modeling their online appearances and finally appearance is used for perceptual coding of ROIs. This is a hybrid-video coding scheme where background is coded using regular DCT-DPCM based coding (H.264) and ROIs are coded using their online perceptual models. The proposed enhancement of H.264 with perceptual ROI coding is realized by bit-stream format proposal. In low-bitrate applications, this framework is proven to be visually superior to that of H.264/AVC. 3 patent applicationsare filed on this work.

Responsibilities:

* **Object tracking**: from algorithm design to prototyping and implementation
* **Object coding**: compression framework
* **Automatic object(s) initialization**
* **Prototyping** using Matlab & C Coding using **OpenCV**
* Integrating **ROI coding** module within H.264 reference software **JM17.0**
* **Quality and Complexity assessment**

**At STMicroelectronics Ltd. Noida, India**

**Rich 3D capture & Glassless 3D display**

This is about studying and understanding of existing technology in rich 3D capture (including HDR, light-field) and glassless 3D displays including integral imaging, light-field and holographic display; sharing knowledge and defining new project activity in the glassless rendering/display area (new area for the company).

Responsibilities:

* **Project/new activity proposal**
* Knowledge sharing

**2D to 3D Video Conversion**

The challenge in the generation of novel view via depth estimation of the scene is to create realistic good quality 3D effect and also keep the solution computationally inexpensive to fit its future use in STB or TV. Finally, the C code has been ported on ST’s TV chips. Close collaborations were exercised with product group and math group for system-specific algorithmic improvisation and mathematical representation and solution of related problems respectively.

Responsibilities:

* Benchmarking existing solutions from DDD(Tridef), 3Dfier, Philips Research, JVC etc and technical report generation
* **Algorithm design**: **scene/region classification**, **depth estimation** from different cues, merging different **depth cues**, final **depth map generation**, **temporal consistency** of depth map, **stereo view synthesis**
* Collaborations with other research groups within ST, exploring scope of improvement
* **Algorithms implemented** in **C** and **Hardware APIs** for the **C** golden model
* Giving several trainings to several divisions on 3DTV

**Image and Video Quality Metrics Evaluation**

This is about studying and using effective metrics for subjective image and video quality assessment which can well correlate with perceived image and video quality. Video quality is more than evaluating quality of individual still images.

Responsibilities:

* **Analysing** pros and cons of different based image and **video quality assessment metrics**
* Studying **information content** depending upon the image/video type
* Implementation in MATLAB

**H.264/AVC Stereo Coding**

Project Summary: Reference JVT Encoder up-gradation with Stereo SEI analysis/determination and management and developing comparative analysis of performance of stereo video compression vis-à-vis AVC simulcast and MVC

Responsibilities:

* Upgrading **JM15.1** encoder (in **C**) with **StereoVideoInfo SEI** and **FramePacking SEI** messages to generate such streams to improve time-to-market for enabling ST chip having 3D Technologies
* Writing technical report

**Dynamic Transcoder Bit-Rate Controller (DTBRC)**

Project Summary: This Project is about developing a novel bitrate controller for transcoder application which is completely GOP structure independent, scene-change independent and is having features like frame-skipping, bit-stuffing for maintaining buffer-constraint at the same time achieving maximum possible quality at any conditions provided by the user i.e. both the advantages of CBR and VBR are available.

Responsibilities:

* Developing the **new algorithm** & writing the code in **C from scratch**.
* Working for **MPEG2-MPEG4/SP**, **MPEG2-H.264** and **H.264-H.264 transcoding**
* Implementation of **scene-change detection** and handling
* Timing model for **H.264 VBR for synchronous buffer fullness** at final arrival time
* **Spatio-temporal Frame-skipping**
* Writing technical reports & **patent application** (GOP-Independent Dynamic Transcoder Bitrate Controller)
* Code release & support to product division

**Video Transcoding**

Responsibilities:

* **H.264** to **H.264 Transcoding** in C with Information Reuse, profile and bitrate conversion with frame-skipping
* **Performance Enhancement of Allegro Encoder** Golden “C” model in Transcoding Environment
* **MPEG2** to **H.264 Baseline profile transcoding**, display order and reference frame management, de-interlacing (Demo of solution shown in **CES 2007**)
* **MPEG2** to **MPEG4 Simple profile transcoding**, motion vector scaling, display order and reference frame management, de-interlacing
* Transcoding with **arbitrary spatial resolution change**
  + filter design (**nearest neighbour, bilinear and high quality polyphase filter**) for **arbitrarily changing the resolution of still image**
  + Design **algorithm** for **motion vector re-estimation** for **variable size partitions** and macroblock modes
* Writing technical reports and patent proposals
* All the solutions went to firmware of STB chips, providing support to product divisions

**At Interra Systems, Noida**

**Interra H.264 Analyzer (Vega) Project**

Project Summary: Enhancement of H.264 Analyser (Vega) with ETS (European Telecommunication System) and ATSC (Advanced Telecommunication Standard Committee) transport stream module, MP4/3GPP module in the H.264 Analyser so that it can be used to verify a transport stream’s compliance with the defined standard and pinpoint problem areas. Responsibilities:

* Designing and Developing of **Interra TraceViewer** in **Vega Analyzer**
* Developing of **MP4/3GPP Analyzer** for **Vega** in **C, C++ in .Net** environment
* Developing module on **ETS/ATSC** (SIT handler) in **Vega**

**At CDAC - Kolkata**

**Undergraduate Internship Projects** (June 03 to July 03 and April 04 to May 05)

* Developed **Tea-analysis Software** as a part of **e-Nose/e-Vision** Instrument for Black Tea Quality testing delivered to around 20 Tea gardens in India and Kenya (Vocational Training)
* Developed “**Bengali typing tutor**”: an integral part of C-DAC, Kolkata's Computer-in-the **Classroom Training in Bengali** on "Functional ICT" given to the District e-Governance centre in West Bengal and also Secondary School Students under Sarva Skiksha Avijan(B.Tech Final Year Project)
* Developed a part of “AnglaBangla”: **Translation software from English to Bengali** (BTP)