EVS machine-learning and computer vision Internships 2024-2025

Novel view synthesis with NeRF

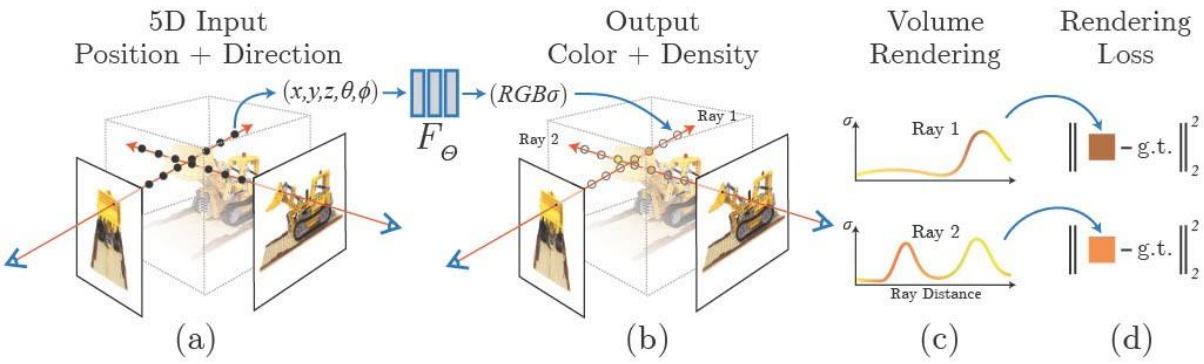
Keywords: NeRF, viewpoint synthesis, photorealist rendering

Neural Radiance Fields (NeRF) is a rapidly evolving field in computer vision, and in a few years from now, you will have the ability to watch sports replay from any viewpoint. The objective of the internship is to investigate the use of NeRF for viewpoint synthesis under real-world conditions, such as dynamic environments and limited camera perspectives, while adhering to challenging requirements such as achieving photo-realism in real-time.

As a member of a collaborative team effort, you will contribute to the development of a cutting-edge pipeline, spanning from camera setup to 3D model export and integration with game engines such as Unreal Engine. You will be assigned to a specific segment of the pipeline based on your personal preferences and will be tasked with investigating the latest developments in the field to push the boundaries of what is currently achievable.

Under the guidance of a computer vision engineer, you will be responsible for reviewing relevant literature, selecting the most appropriate methods, testing and validating their effectiveness. You will be working in collaboration with fellow interns and computer engineers to integrate your findings into the project pipeline.

The ideal candidate should possess knowledge in Deep Learning and be acquainted with the PyTorch framework. They should have prior experience in developing machine learning models and demonstrate an interest in both 3D reconstruction and computer-generated animations.



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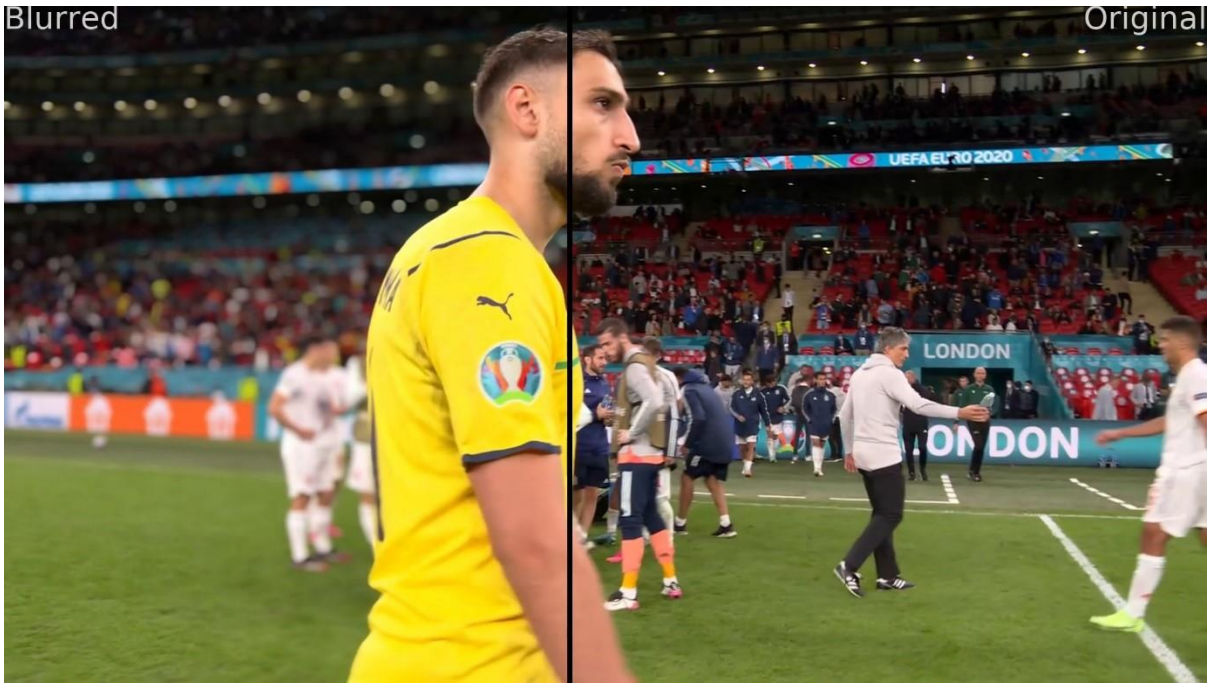
Bokeh Effect Synthesis

Keywords: Bokeh, cinematic effect, depth-of-field

Cinema cameras are more and more used in a live sport broadcast context to generate the so-called bokeh effect. This effect is what is obtained when a short depth-of-field camera is used to highlight a specific subject by contrast with the background which presents an enjoyable out-of-focus blur.

These cameras and their lenses are however cumbersome to integrate in a live production, on top of being very expensive. This is why there is a strong benefit to generate this effect synthetically, based on regular cameras. EVS is already working on its own bottom-up method, but it has some areas of improvement.

The intern will thus be responsible for reviewing the literature about depth-of-field, cinematic or bokeh effect synthesis. He will test available codes, implement the most promising methods in PyTorch and train them. Moreover, the intern will compare the different methods both quantitatively on public benchmarks and qualitatively on relevant videos in order to choose the best method and hyperparameters for EVS. The intern will need to be able to work quite autonomously, while receiving regular guidance and relevant help from members of the Innovation team.



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Logo detection in sport videos

Keywords: One-shot learning, zero-shot learning, logo, detection

Logo detection is a key component for several broadcast applications: automatic blurring of advertisements for product types that cannot be advertised in some regions (i.e. advertisement of tobacco in France), automatic measurement of screen time of brands that paid for X minutes of advertising, etc. Such task is challenging given that logos are often partially occluded, deformed by object orientation and camera projection, blurred by object and camera motions, badly illuminated, and so on. In parallel, logos undergo design changes over time and new logos keep emerging.

Under the supervision of computer vision engineers of the Innovation team, you will be responsible for reviewing the literature, selecting the most appropriate methods, training, testing, and validating their effectiveness on various sport content.

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Automatic retargeting of broadcast videos

Keywords: Framing, tracking, detection, saliency

This internship focuses on using recent advances in artificial intelligence (AI) to automatically retarget broadcast video. Video retargeting involves improving the focus of videos by zooming in on precise moments missed by the camera or adapting the video to different aspect ratios, such as the popular 9:16 format for mobile viewing.

This internship will explore novel AI methods, including player or ball tracking and detection of eye-catching events within the video, to automate these processes. In addition, for scenarios involving the 9:16 aspect ratio and interview content, the aim is to identify speakers to enable automatic cropping to focus on the individual speaking. These technologies aim to streamline the retargeting process, improve the efficiency and accuracy of video production, and enhance the viewing experience for audiences across platforms.

Under the guidance of computer vision engineers in the innovation team, your work will include literature review, selection of the most appropriate methods, training, testing and validation to assess their effectiveness on sports content.

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EVS machine-learning and computer vision Internships 2024-2025

Virtual Offside Line Research

Keywords: VAR, VOL, calibration, player detection, pose estimation, tracking

Xeebra is the virtual assistant referee tool developed by EVS. This product includes a Virtual Offside Line functionality that is essential for soccer games nowadays. In order to ease the drawing of the offside line in augmented reality, this VOL feature contains sophisticated deep learning and computer vision algorithms. With the current state of the art in human and limb tracking, it is now possible to almost automate the offside line positioning completely.

Depending on the current needs of the team and mostly on interests of the intern, the goal of this internship is to work on improvements of some specific sub-parts of the VOL component. It could be an investigation about camera calibration, soccer pitch detection, player limb detection and tracking, player 3D skeleton reconstruction, human mesh generation, ...

There are many ways to conduct research around refereeing in soccer, but in any case, the intern will be guided by one or two computer vision engineers, and the intern will get the chance to perform scientific research that will benefit to a real-world product. The internship will consist in reviewing the state-of-the-art methods relevant to the chosen problem, setting up an experimental environment to implement and test the computer vision/deep learning algorithms, and finally a quantification of the benefits of the research conducted by the intern for the product.

The ideal candidate for this internship has a good background in deep learning and computer vision, especially on camera calibration, and some experience with python, PyTorch, and Linux.

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EVS machine-learning and computer vision Internships 2024-2025

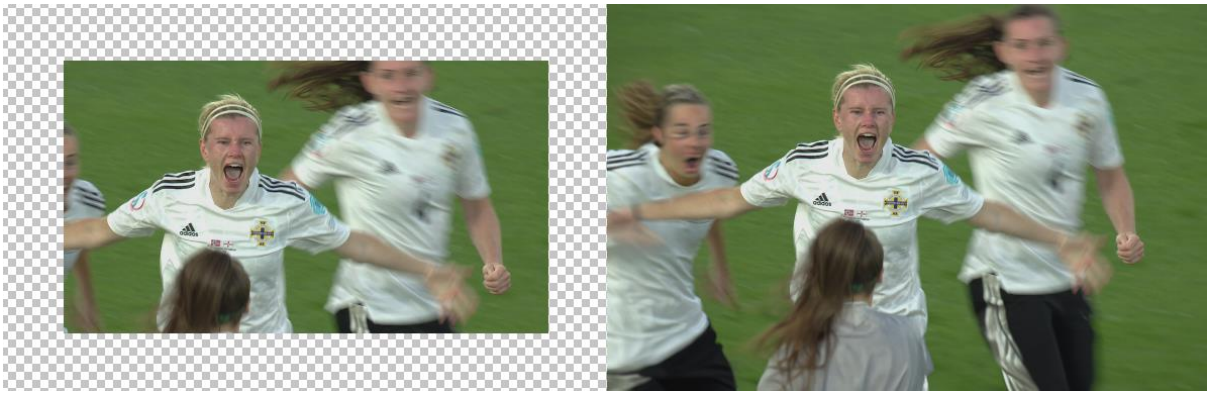
Generative AI for Outpainting in Sport Content

Keywords: Outpainting, generative AI, diffusion models

Inspired by non-equilibrium thermodynamics, diffusion models (DMs) are gaining significant popularity. Compared to GANs, these generative models are more stable to train and are producing image of greater quality. The growing amount of ongoing research demonstrates the efficacy of such model across various applications.

A possible application of diffusion models lies in outpainting images, seamlessly extending the borders of video frames and enabling dynamic aspect ratio adjustments in sports broadcasting. This innovation enhances viewer immersion and engagement, elevating the overall viewing experience across different devices. We believe that diffusion models can help in generating photorealistic details beyond the limits of camera sensors. Such techniques offer new creative avenues for content production and audience engagement.

Your role will involve immersing yourself in the latest research literature, identifying the most suitable methodologies, honing your skills in model training and testing, and ultimately validating the effectiveness of these techniques on a diverse range of sports content. This internship offers a collaborative experience within EVS's innovation team, and your work will take place under the guidance of a seasoned computer vision engineer.



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EVS machine-learning and computer vision Internships 2024-2025

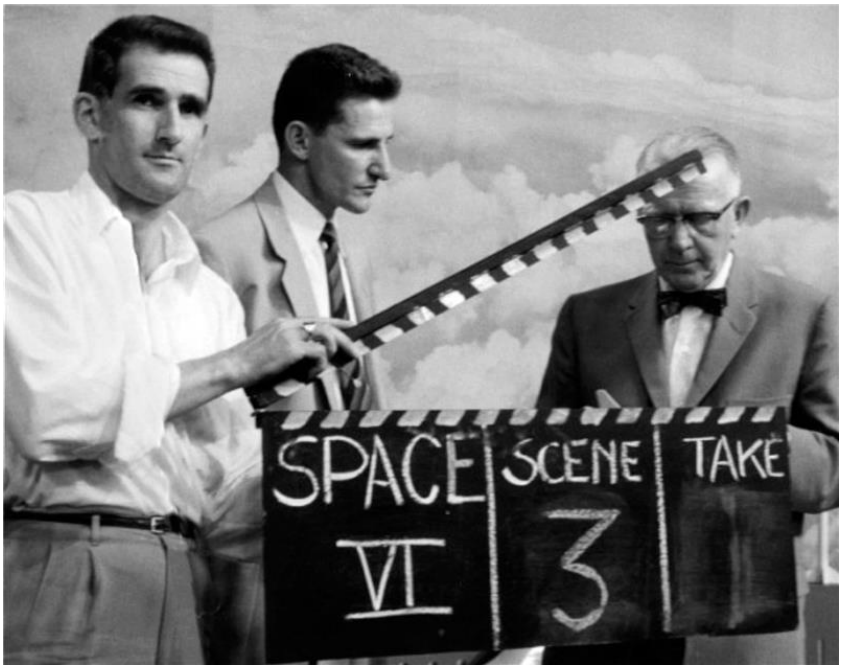
Synchronization of picture and sound using joint analysis of audio and video streams

As of today, audio and video streams follow different processing paths in broadcast workflows. As each processing path may cause a different latency, it's often necessary to re-synchronize the produced audio and video streams before making them available to viewers. A common way to synchronize audio and video tracks is to use a *clapperboard* to produce a sharp noise associated with a strong visual cue that an operator can later leverage to determine the best delay to be added either to the audio or to the video track in order to guarantee a proper synchronization of picture and sound, free of any lip-sync or any other related issue.

The objective to this thesis is to investigate how joint audio and video ML-based processing can be used to automatically determine the above-mentioned delay, ideally without resorting to using a clapperboard.

From a high-level perspective, the thesis should comprise the following steps:

- Review of the existing scientific literature on related topics.
- Selection and evaluation of the most promising techniques.
- Selection or building of a dataset to train and evaluate the techniques. While turnkey datasets may exists in the scientific community, one should note that it's straightforward to generate ground truth data for this task.
- Based the experiments above, design of a candidate method to fulfill the thesis objective.
- Implementation of the designed technique.
- Evaluation of the designed technique on the selected or custom-built dataset.



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