Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:M21-170L^
Published: 1/24/2022

Inventors

Fatemeh Haghighi
Mohammad Reza Hosseinzadeh Taher
Zongwei Zhou
Jianming Liang

Contact

Jovan Heusser
jovan.heusser@skysonginnovations.com

Transferable Visual Words (TransVW)

-

Computer-aided diagnosis (CAD) systems are invaluable in helping physicians better diagnose and treat diseases by using Artificial Intelligence (AI) to interpret medical images. Motivated by the early success of CAD systems, particularly those developed using deep learning algorithms, there is an intense interest in adopting them for applications in several medical specialties. However, the scarcity and difficulty in accessing annotated data in many medical specialties pose a significant challenge to the success of these CAD systems.

To overcome this challenge, researchers at Arizona State University have developed an annotation-efficient deep learning framework, minimizing the human annotation efforts for developing high-performance CAD systems. This framework, called TransVW, is established on the self-supervised learning paradigm, gleaning medical knowledge from images without human annotations. TransVW is prominent for its capacity to develop a collection of base models that can be used as a starting point for training application-specific models, resulting in rapid progress and improved performance for various medical tasks. Moreover, TransVW boasts a unique add-on capability, boosting the performance of existing self-supervised learning approaches.

The comprehensive evaluations on seven 2D/3D medical tasks demonstrate that TransVW achieves superior performance in disease detection and organ segmentation, accelerates the training of deep learning models, and reduces human annotation efforts compared to the previous state-of-the-art methods.

Potential Applications

- Computer-aided diagnosis for many different diseases (e.g. lung nodule, embolism, brain tumor, thorax diseases, etc.) in any organ and using any imaging modality (e.g. CT, X-Ray, MRI, etc.)
- 3D medical image analysis
- Medical anomaly detection
- Non-medical applications – Satellite image analysis

Benefits and Advantages

- Self-supervised—leveraging human anatomy embedded in unlabeled medical

images for training self-taught models
- Comprehensive—incorporating multiple objectives for learning common anatomy
- Robust—preventing superficial solutions for deep learning
- Versatile—complementing existing self-supervised methods for performance enhancement
- Curating a dataset of anatomical structures, associated with semantically meaningful labels, from unlabeled medical images via self-discovery
- Learning semantics-enriched information from human anatomy via self-classification and self-restoration
- Outperforming learning 3D models from scratch and other existing 3D pre-trained models
- Accelerates the training process of deep learning models
- Reduces annotation costs dramatically
- Surpasses 2D approaches

For more information about this opportunity, please see

Highighi et al - IEEE TMI - 2021

TransVW - Github

For more information about the inventor(s) and their research, please see

Dr. Liang's departmental webpage