深圳北理莫斯科大学
УНИВЕРСИТЕТ МГУ-ППИ В ШЭНЬЧЖЭНЕ
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应用数学讲座

Научный Семинар по Прикладной Математике

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应用数学报告（46）

报告人 / Докладчик / Speaker: 王彦飞 研究员

题目 / Название / Title: High resolution seismic faults interpretation based on adversarial neural networks with regularization technique

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地点 / Место / Venue: 主楼 336

摘要 / Аннотация / Abstract:

Geological fault detection at high precision and resolution is the key for fine structure and reservoir modeling (Di et al., 2017; Wang et al., 2018). Previous studies using neural networks for fault segmentation mainly focus on the local features of the targets (Huang et al., 2017; Zheng et al., 2014) and train the networks using synthetic datasets (Cunha et al., 2020; Wu et al., 2019). To increase the fault segmentation resolution only using a limited amount of seismic field data, we propose an adversarial neural network architecture for high-resolution identification of faults (FaultAdvNet) taking advantage of global feature fusion. The architecture consists of (1) a light-weight segmentation module (~0.49M parameters), (2) a feature fusion module considering reflectors of both faults and surrounding stratums, and (3) a discriminator module acting as a regularization term. Case studies using seismic field data from the Gulf of Mexico showed an overwhelming performance improvement of the FaultAdvNet when compared with other fault detection methods. The FaultAdvNet picks all the faults with significantly high confidence and low prediction risk. The predicted faults of the FaultAdvNet are in good continuity and show clear boundary with fault probability values mainly range from ~0.95 to 1. Saliency analysis also suggests that the FaultAdvNet can focus on the target at a significantly higher resolution (dozens of meters). Functionality experiments verify the mechanisms of the feature fusion module and the discriminator module in FaultAdvNet. We consider that a neural network (like the discriminator) can serve as a data-driven regularization term to constrain the target network (the segmentation network) efficiently, especially given a limited amount of seismic data.

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王彦飞研究员简介：

王彦飞研究员任中国科学院油气资源研究重点实验室主任，地球科学大数据与人工智能中心主任，大数据分析方法与智能计算学科组组长。2013 年获国家杰出青年科学基 金资助。2016 年获国家自然科学基金重大研究计划项目资助。2018 年获国家重点研 发计划项目资助