
Uczenie Głębokie Dla Kriomikroskopii Elektronowej

Zespół

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 - Radosław Kuczbański

Współpracownicy

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- dr Lukas Frey
- dr inż. Piotr Klukowski

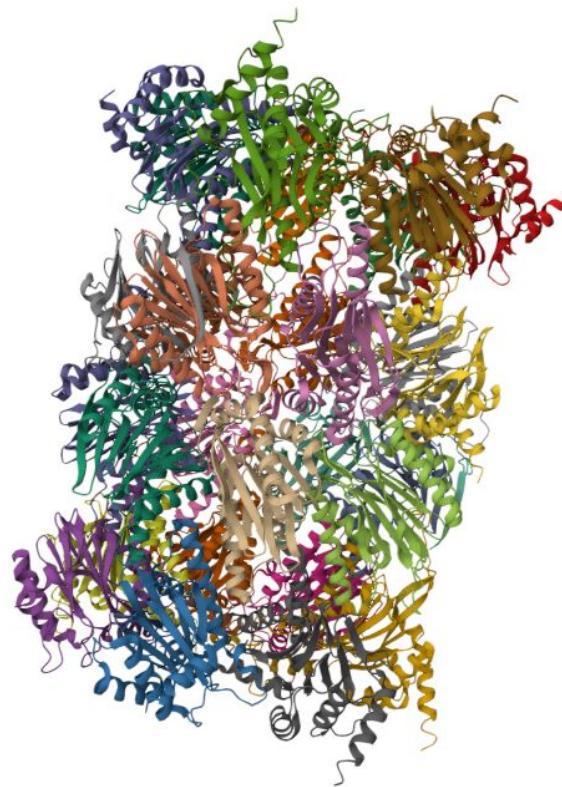
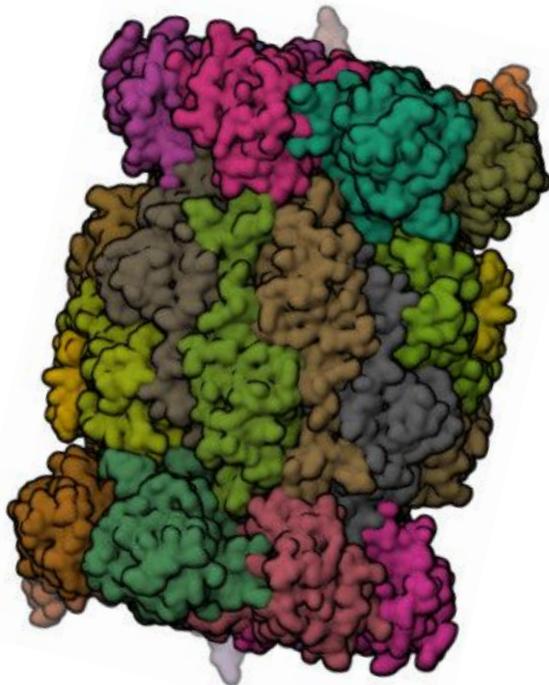
Opiekunowie

- dr hab. inż. Maciej Zięba
- mgr inż. Jakub Binkowski

genwro.**AI**

ETH zürich

Struktury 3D białek



Jak pozyskać struktury 3D?



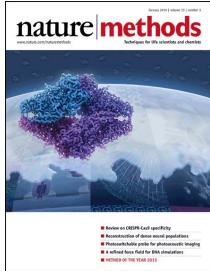
Spektroskopia NMR



Krystalografia
rentgenowska



Cryo-EM



2015

Metoda Roku

Nature ogłasza **Cryo-EM**
mianem „Metody Roku”



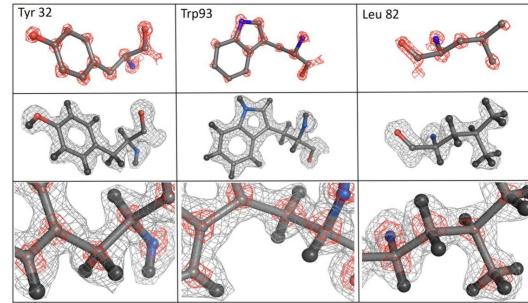
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Jacques Dubochet
Prize share: 1/3



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Joachim Frank
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2017

Nagroda Nobla Prace nad Cryo-EM nagrodzone Nagrodą Nobla



2020

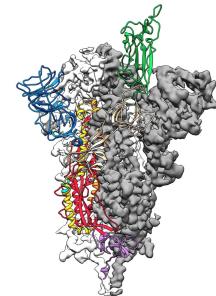
Apoferrytyna

Rekonstrukcja z niemalże
atomową dokładnością

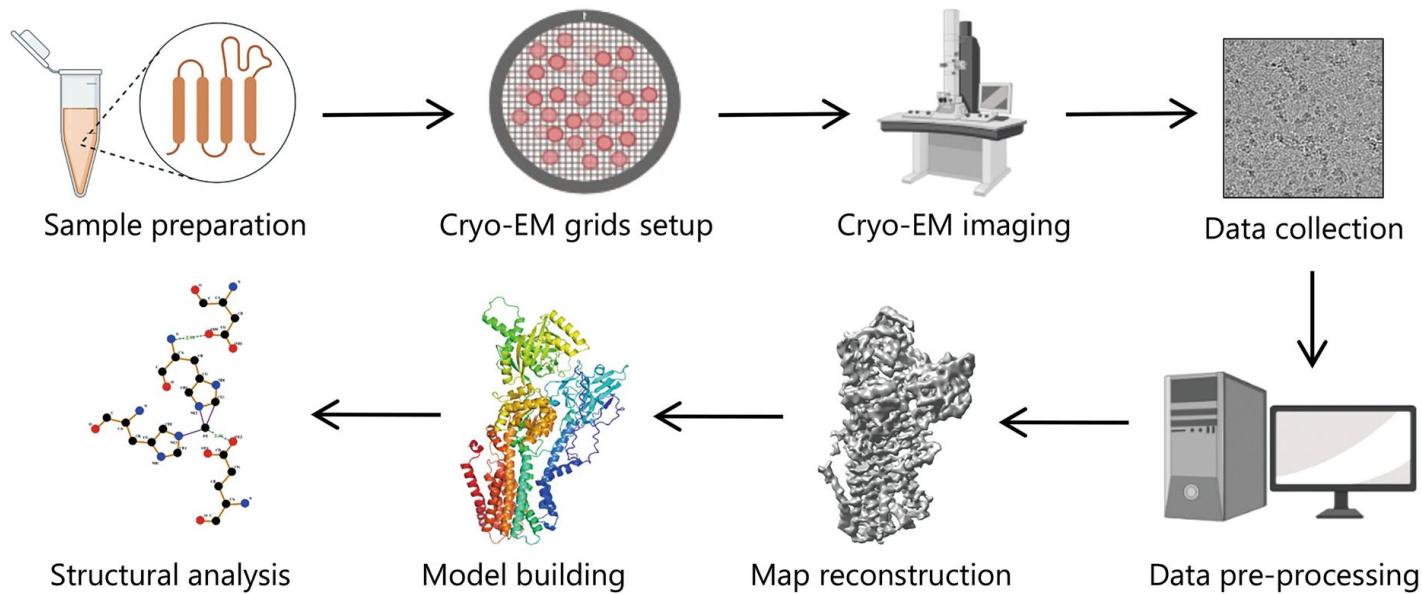
SARS-CoV-2

Rozwiązywanie struktury **spike protein** koronawirusa przy
pomocy **Cryo-EM**

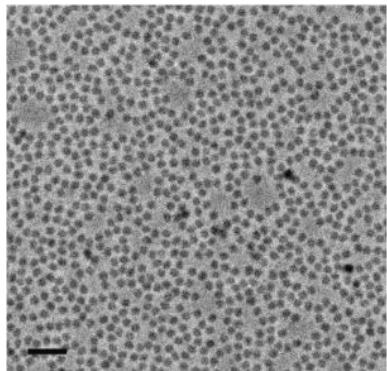
2020



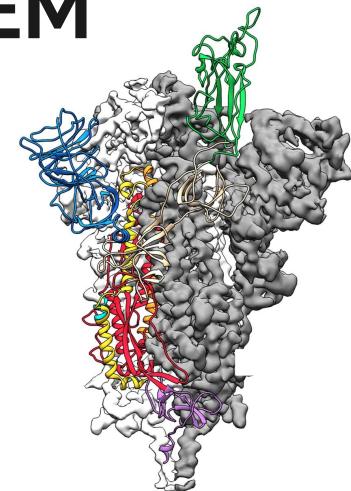
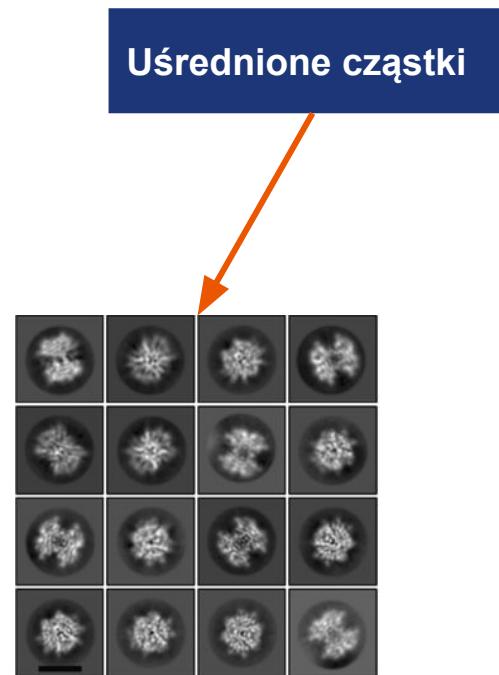
Proces obrazowania Cryo-EM



Przetwarzanie danych w Cryo-EM

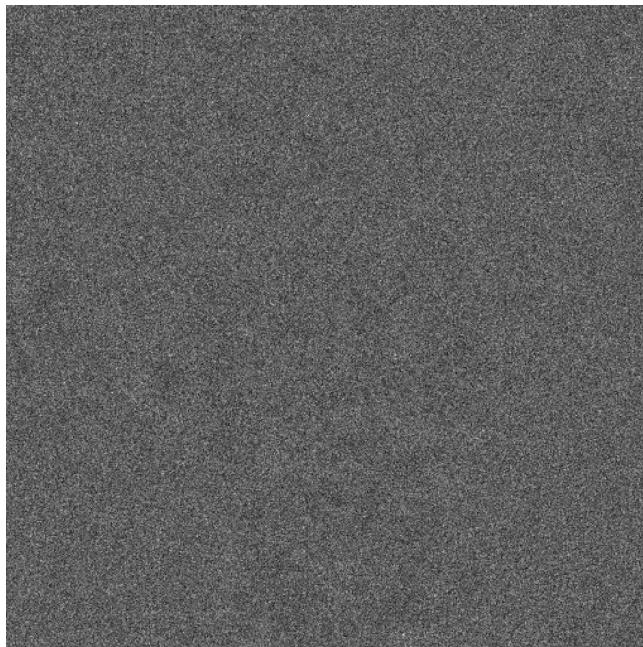


Surowe mikrografie

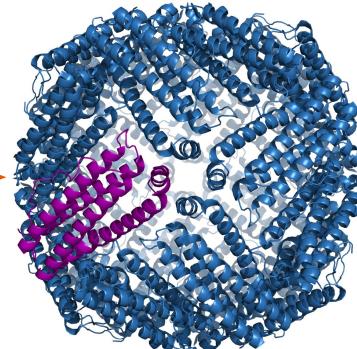


Gotowe struktury 3D

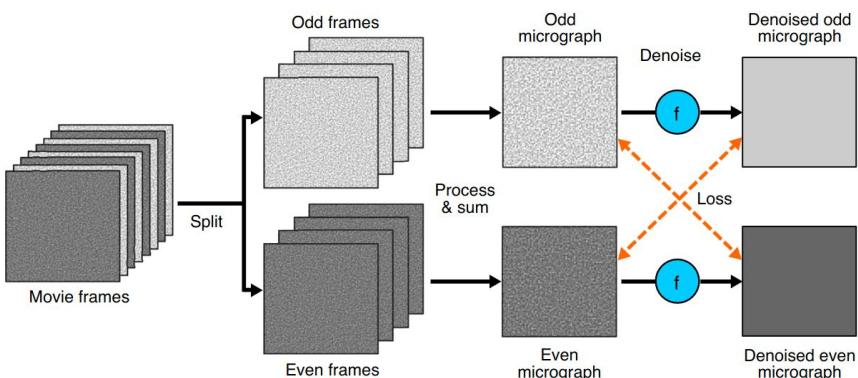
Problem - wysoki poziom szumu



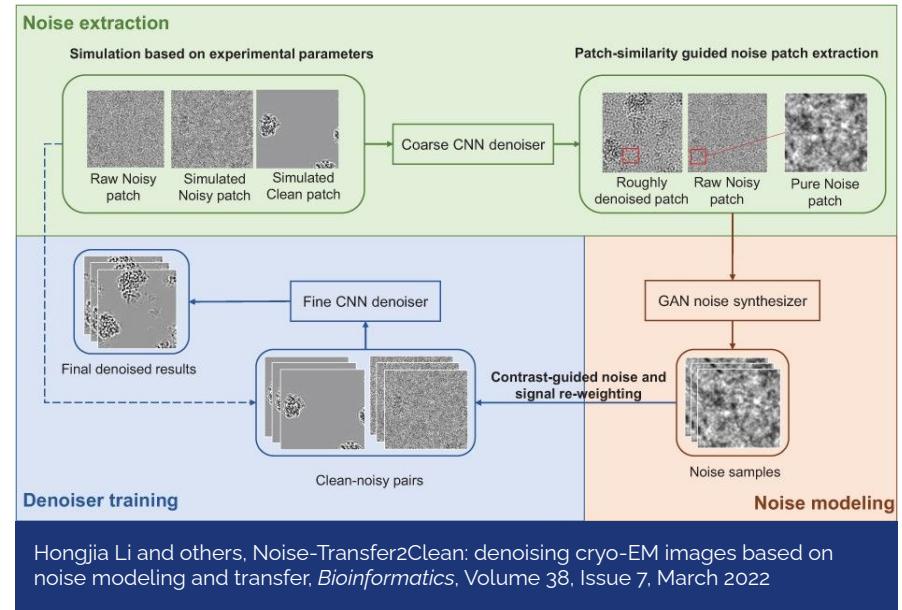
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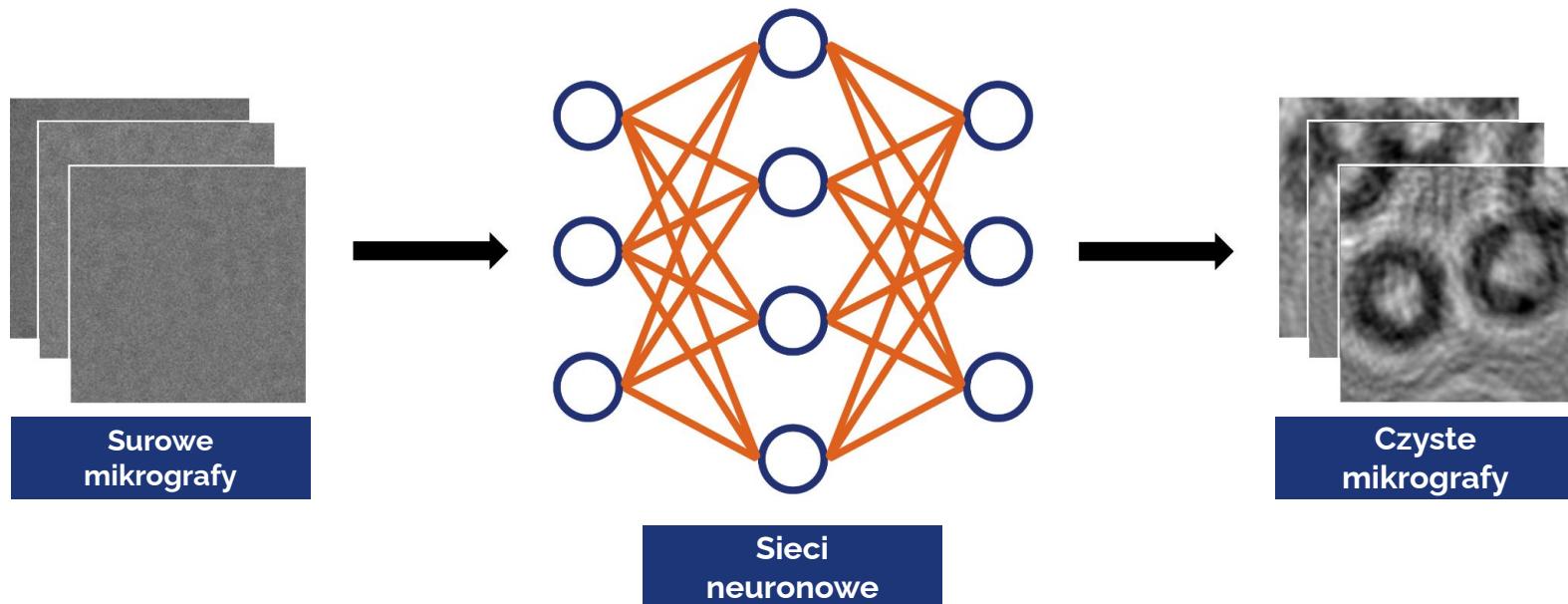
Obecnie stosowane rozwiązania



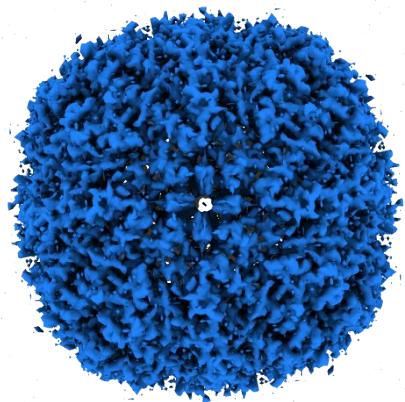
Bepler, Tristan, et al. "Topaz-Denoise: general deep denoising models for cryoEM and cryoET." *Nature communications* 11.1 (2020): 5208



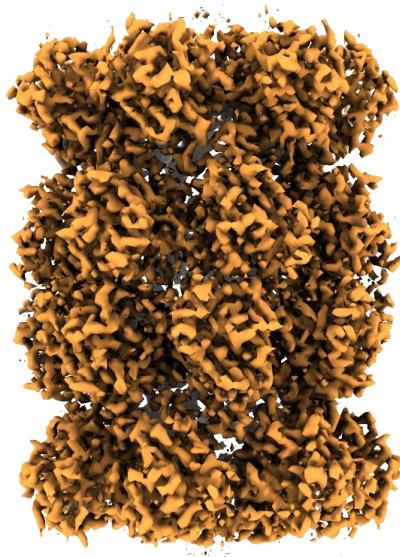
Cel projektu



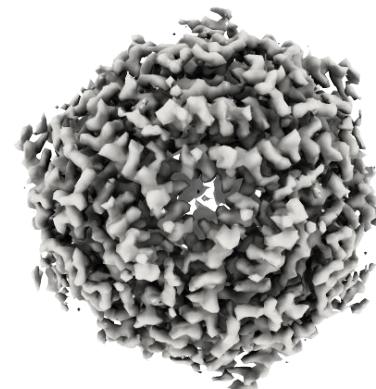
Użyte zbiory danych



Apoferrytyna

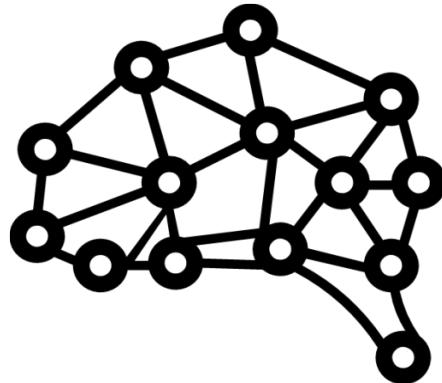


T20S Proteasome

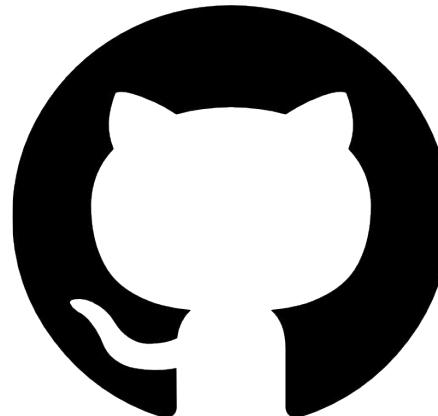


DPS E. Coli

Efekty projektu



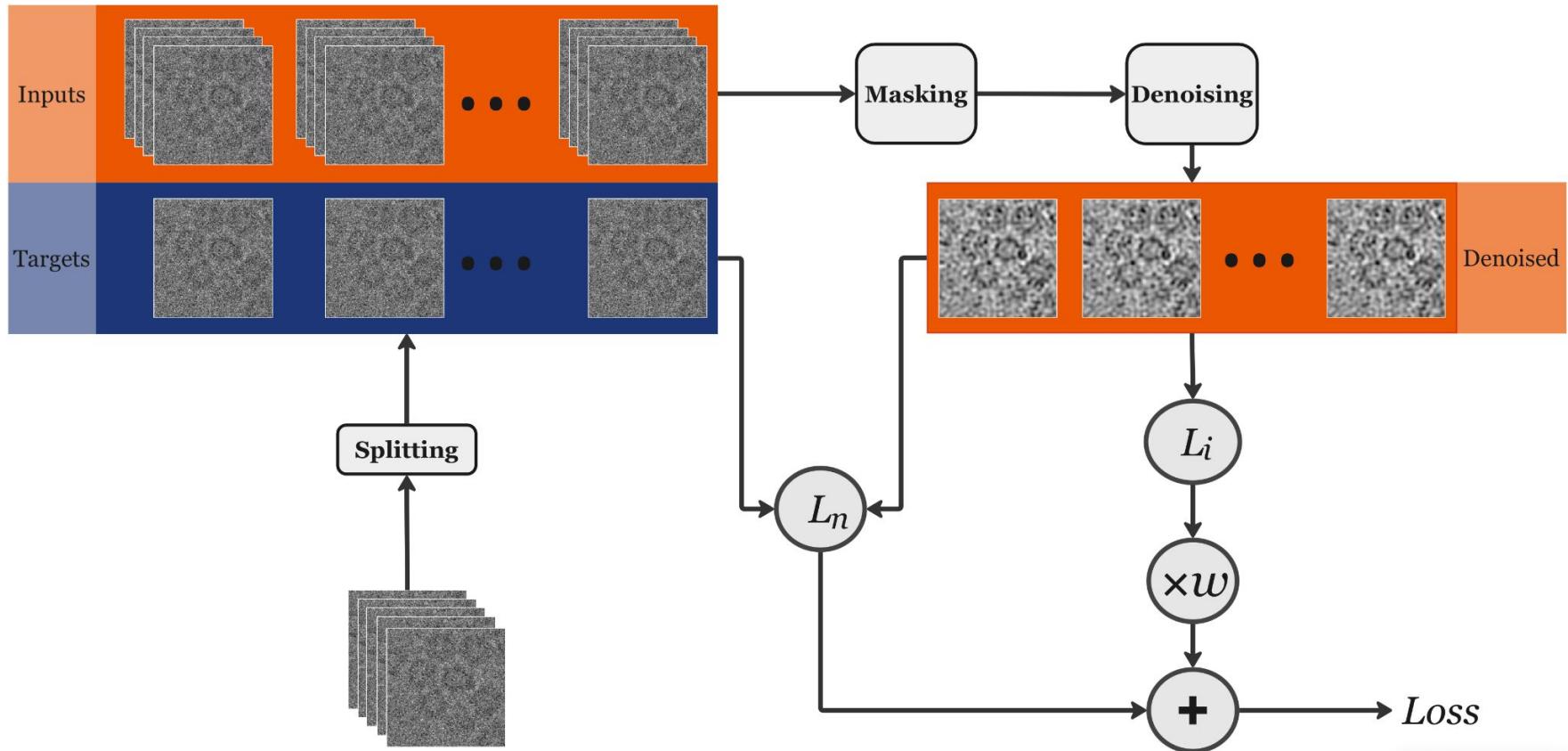
Trzy autorskie metody
odszumiania



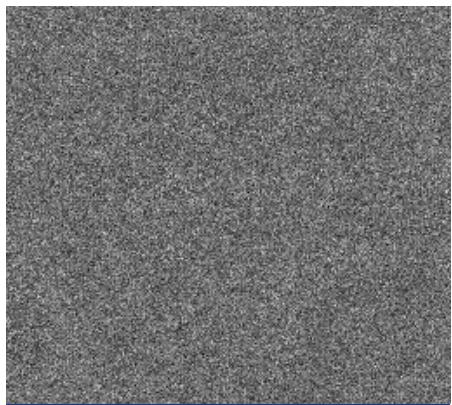
Pipeline przetwarzania
danych z CryoEM



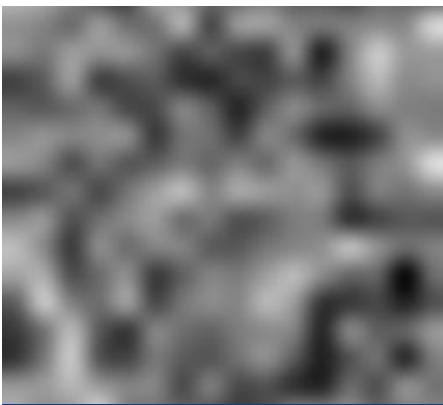
Badania stanowiące materiał
na publikację



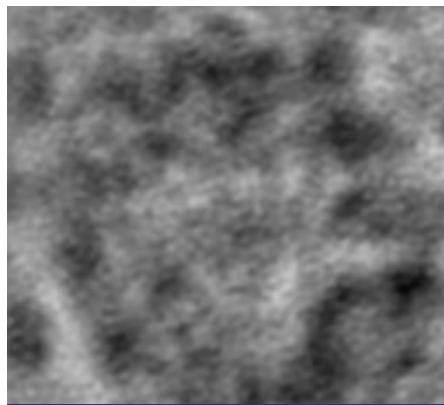
Multi-Noise2Noise - wyniki



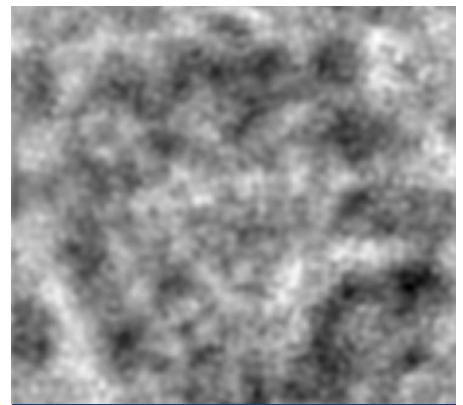
Surowy mikrograf



Filtr dolnoprzepustowy

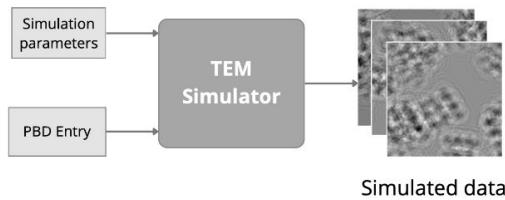


Noise2Noise

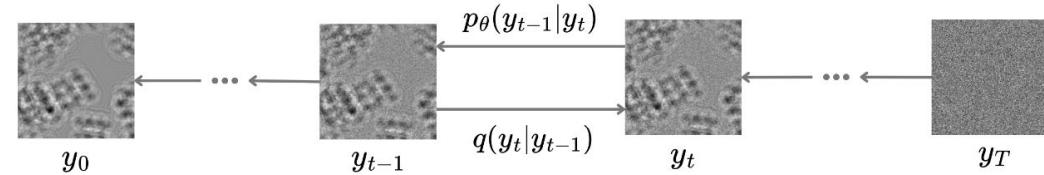


Multi-Noise2Noise
(nasza metoda)

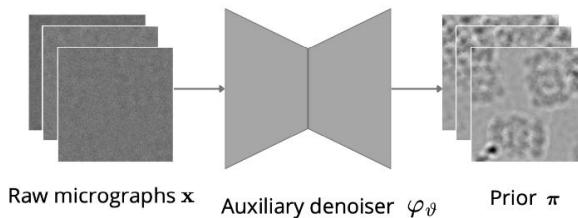
Stage I: Data simulation



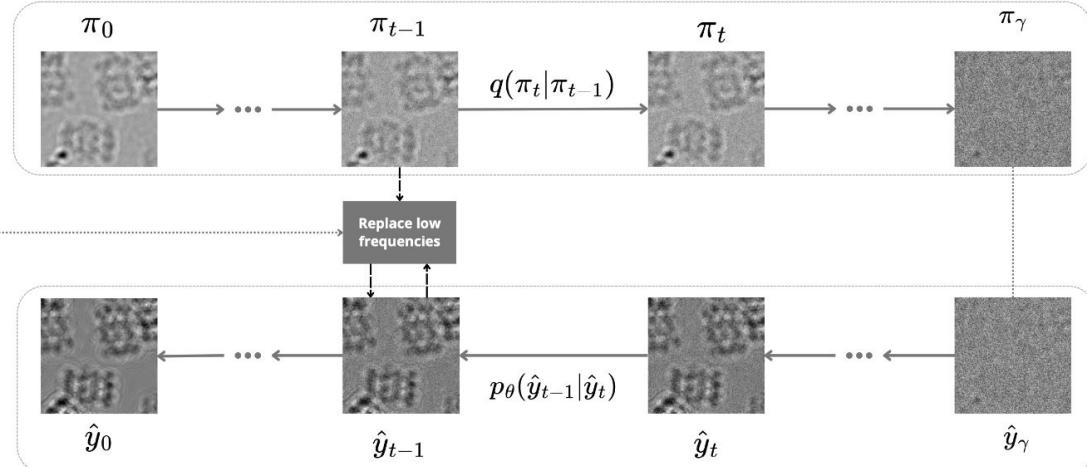
Stage II: Diffusion model training



Stage III: Auxiliary denoiser training

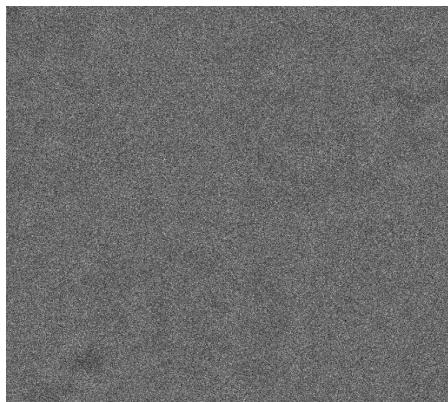


Stage IV: Image restoration

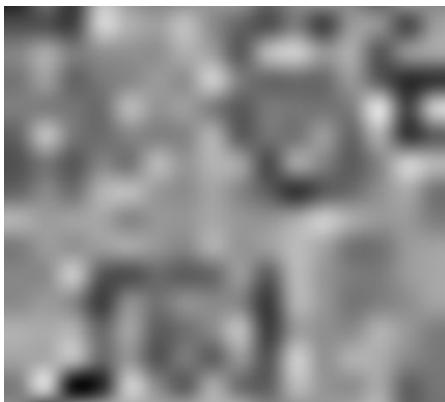


Iterative Latent Variable Refinement

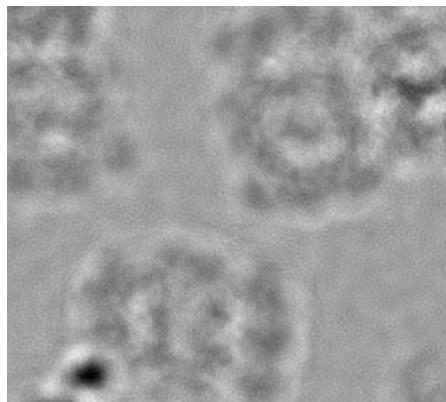
CryoSharp - wyniki



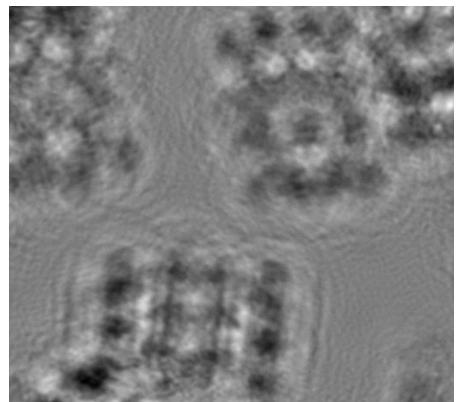
Surowy mikrograf



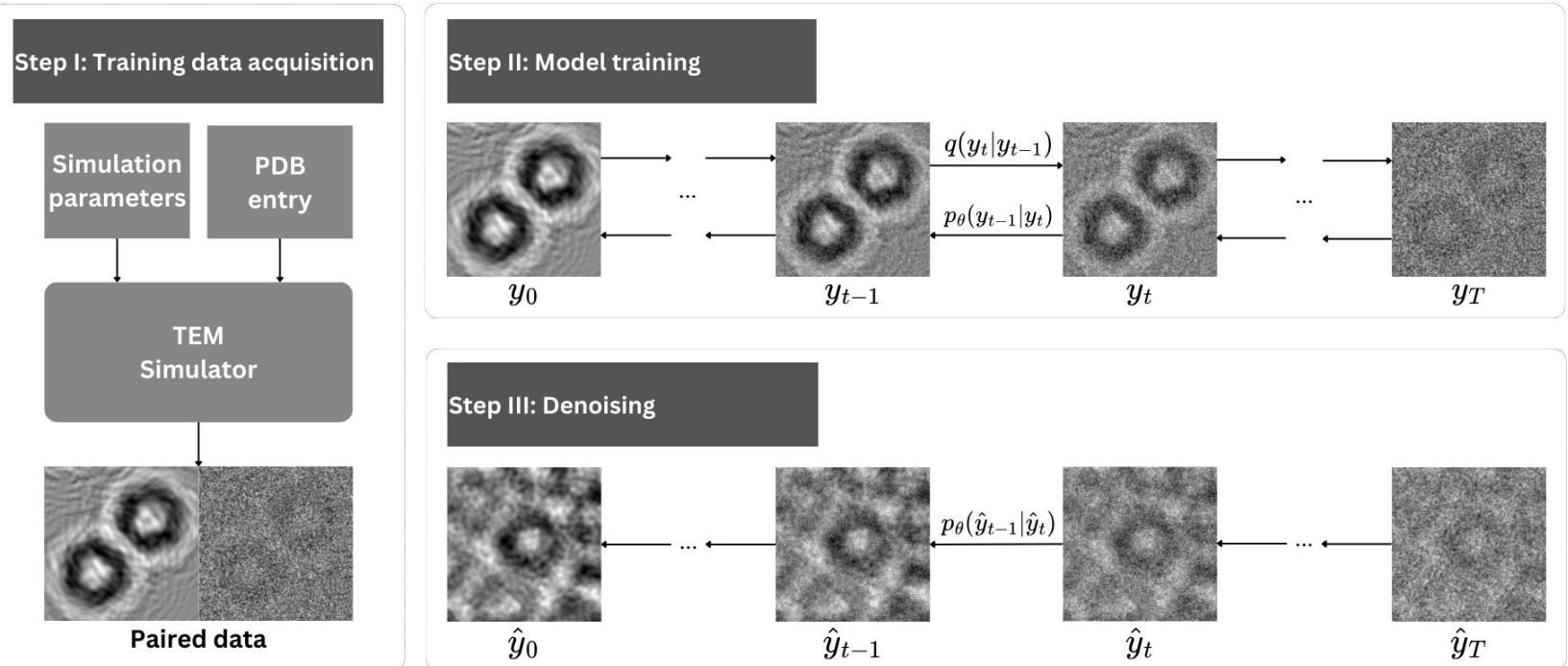
Filtr dolnoprzepustowy



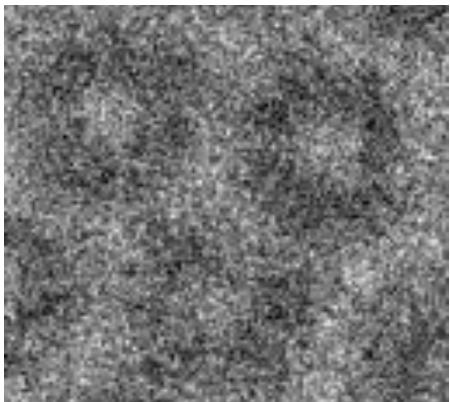
Noise2Noise



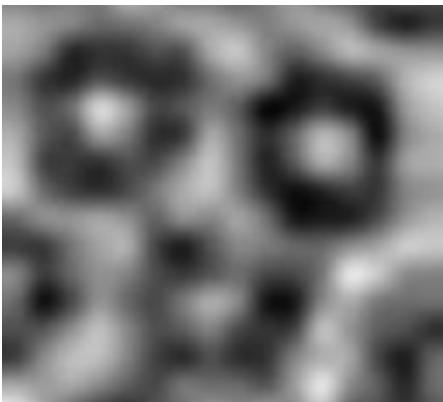
*CryoSharp
(nasza metoda)*



SchrödParticle - wyniki



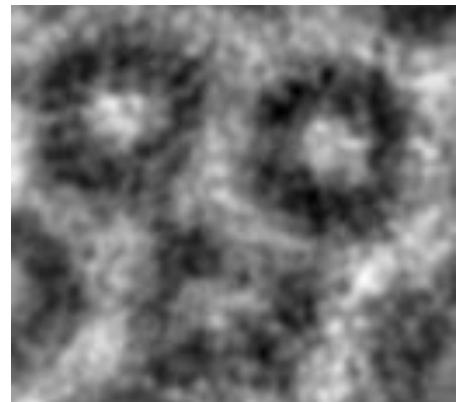
Surowy mikrograf



Filtr dolnoprzepustowy

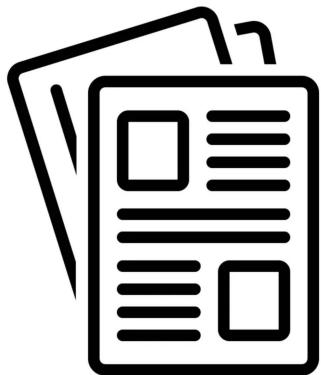


Noise2Noise



SchrödParticle
(nasza metoda)

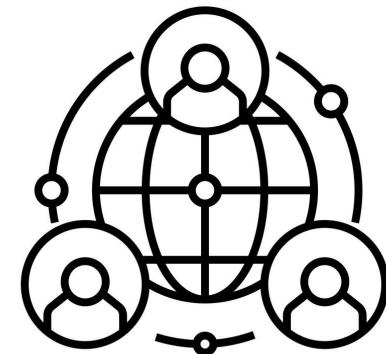
Dalsze plany



Publikacja wyników



Kontynuacja prac podczas
studiów doktoranckich



Kontynuacja współpracy
badawczej



Dziękujemy za uwagę

Q & A