The main goal of this project is to develop predictive models for monitoring physicochemical changes in osmotically dehydrated sour cherries and apricots during drying using nondestructive techniques based on computer vision (CV) and artificial intelligence (AI), including deep learning and traditional machine learning. This innovative research addresses significant knowledge gaps concerning the combined effects of osmotic dehydration, drying technologies, and quality changes during processing.

The study will be focused on two cultivars of sour cherry (*Prunus cerasus* L.: 'Łutówka', 'Nefris') and apricot (*Prunus armeniaca* L.: 'Harcot', 'Early Morden'), sampled across three growing seasons.

Seven specific scientific objectives guide the research:

1. comparing the influence of sucrose, xylitol, and erythritol solutions on physicochemical properties of sour cherries and apricots;
2. assessing how osmotic dehydration affects drying kinetics;
3. evaluating the impact of three drying techniques—hot air convective drying (HACD), ultrasound-assisted hot air convective drying (UAHC), and infrared-assisted hot air convective drying (IAHC)—on fruit quality;
4. analyzing changes in image features over time using a smartphone, digital camera, and flatbed scanner;
5. correlating image-based features with key physicochemical attributes;
6. developing predictive models to estimate internal quality based on external image features;
7. investigating the effect of storage on osmotically dehydrated dried sour cherry and apricot quality using destructive and nondestructive assessments.

The study will answer whether different osmotic solutions and drying techniques significantly affect quality attributes and whether structural changes can be detected through image analysis using 3 imaging devices: a smartphone, a digital camera, and a flatbed scanner. Also, this work will study potential interactions among cultivar, osmotic solution, and drying technique that impact final quality, and how accurately image features can predict physicochemical changes using CV and AI.

The project also assumes that device selection will influence prediction accuracy and that image data can be reliable parameters for estimating internal food quality.

As output, the project will generate novel datasets linking changes in dry matter, moisture content, water activity, shrinkage, pH, acidity, color, total soluble solids, anthocyanins, sugars, carotenoids, and thermal properties to texture features extracted from images across multiple channels (R, G, B, L, a, b, X, Y, Z, U, V). This will enable the development of AI models capable of accurate physicochemical quality monitoring using images. The anticipated outcomes will advance the fields of food drying, quality control, and smart processing, providing a foundation for applying AI-based prediction tools to monitor physicochemical changes during fruit drying. The methodologies and models developed will support the wider application of AI and CV in agri-food engineering, with benefits for research, and food quality assurance.